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What "Show Week" Will Reveal in Equipment Design

ADVANCE information on the machine tools that will be shown at Cleveland two weeks hence proves conclusively that motor car design is having a profound effect on machine tool design. Some, at least, of the features of automobile design have been current practice in the automotive field for so long that it is difficult to understand why they were not accepted sooner. It must be remembered, however, that in an industry as old as the machine tool industry there is an inborn conservatism that demands full proof of the merit of new things before accepting them in place of time-tried practice. Then, too, the average machine tool company has been forced to operate on a profit margin so small that but little has been available for research or experiment.

Despite their handicaps the machine tool designers have done a job that compares more than favorably with the accomplishments of any other group of equipment engineers. This year's show will prove the statement. Certainly no other type of production machine can show the same quality of materials as will be found in the modern machine tool; nor so general an adoption of anti-friction bearings and automatic oiling.

When it comes to facility of operation the machine tool is in a class by itself. Experts in the theory of motion study have criticised machine design on the ground of lack of thought for the convenience, comfort and even health of the operator, but the tools to be seen at Cleveland will not be open to such criticism.

All of the tools to be shown testify to the severity of the demands of modern metal working. The cry of the machine user is for greater strength and rigidity and constantly higher speeds of production. The tool builder's answer is an increase in weight, a strengthening of critical sections and a substitution of sturdier materials for those no longer adequate. Also, an improvement in the driving mechanism through the use of anti-friction bearings on rotating shafts, multiple electric motors driving directly instead of through complicated gearing, clutches of greater capacity and better design, more efficient lubricating systems, built-in work-handling devices and hydraulic feeds.

Opinions on the relative merits of standard and single-purpose machines are diametrically opposed. There is considerable evidence, however, of a movement that is a compromise between the two positions. A builder of drilling machines, for example, has designed a series of self-contained units that can be combined in endless variety to suit the particular requirements of the individual customer. Likewise, a maker of threading machines provides various combinations of standard units as ordered.

An outstanding development in machine tool design that will be evident on all sides at the show is the use of anti-friction bearings. No standard practice in the application of these bearings has as yet appeared. Some builders use only ball bearings, others only roller bearings, while one maker has built one new model entirely equipped with ball bearings and another one entirely equipped with roller bearings.

A builder of grinders points out that the machine he designed two years ago was fitted with six ball bearings while its latest successor has 28. This is typical. On many machines the plain bearing has practically disappeared.

Perhaps the commonest usage is to apply both types of anti-friction bearings, each one where the designer believes it to be best suited.

Although the anti-friction bearing is quite generally accepted for transmission and feed shafts there is still,

apparently, an uncomfortable feeling that it is not quite orthodox to use it on the spindle. Even this stronghold of design fundamentalism is yielding, however. At least one lathe builder uses anti-friction bearings regularly on the spindle and another supplies them as optional equipment.

The use of anti-friction bearings in a machine tool cuts down power wastes materially, but other factors have not been neglected. Considerable simplification in the drive has resulted from the use of more than one driving motor in place of more or less complicated gearing and shafting operated by a single large motor. Evidently there is no longer any doubt of the reliability of the electric motor. At the same time there is additional need for reasonable standardization of motor dimensions. Lack of it complicates the design problem needlessly.

The automobile-type disk friction clutch is more generally used although here again there is a difference of opinion. Some designers prefer the positive clutch and are working away from the friction type.

Countershafts are very scarce. Motor mountings show distinct improvement, some of which is probably due to the relatively new multiple V-belt drive that permits extremely short shaft center distances. Still further simplification has been achieved by connecting the motor directly to the main shaft through a coupling.

ALMOST without exception the authors of the articles in the series, "Getting the Most Out of Your Machine Tool Dollar," selected inadequate lubrication as the most serious defect in machine tools. The criticism has apparently been taken to heart for the great majority of the new models show that careful attention has been paid to this detail.

Flood lubrication is rather generally applied to gear boxes. Pressure-gun greasing is used on many tools for isolated rubbing points. Full force-feed oiling of a whole machine has also been accomplished. Either a circulating or "one-shot" system is used for the purpose. Obviously, automotive practice has been closely followed, and with excellent results. One manufacturer states his belief that hand-oiling will eventually be entirely eliminated. In his own product this desirable end has practically been reached now.

Another machine builder who has applied a circulating force-feed system also installs an oil purifier of the type used on the modern automobile.

Practically the only device auxiliary to the automobile power plant that has not been adapted to machine tool use is the air cleaner and as yet there is no occasion to apply that. When it comes to push-button control the machine tool is far ahead of the automobile. Starting, stopping, jogging, traversing, feeding, can all be accomplished by pressing the proper button. The operator of a modern machine tool, in fact, hardly has to exert himself at all. Which is quite contrary to old ideas of the fitness of things but leaves him as fresh and efficient at quitting time as he was an hour after starting work. Not only is production thereby increased but the operator is a very much more contented citizen.

Much has been done in progressive shops where heavy work has to be handled toward getting it in and out of the machines with the least strain on the men and the smallest chance of accident. Generally the means adopted has been entirely separate from the production machine and therefore not necessarily well fitted to work with it to the best advantage. More attention is now being paid to this feature. Built-in handling devices are not new, of course, but they are now being applied to types of machines that have not been so equipped heretofore.

A tendency that is rapidly becoming pronounced is to use hydraulic feeds and traverse movements instead of gearing. Particularly rapid strides have been made in applying this type of feed to drilling machines, grinders, and broaching machines, although other types also have been so equipped. Strong claims are made for the speed, accuracy, low maintenance cost and general efficiency of hydraulic control and they are apparently justified, if its popularity is a safe criterion.

As usual there are interesting developments in the art of grinding. New abrasives and new types of wheels promise revolutionary advances in production possibilities. Grinding of machine ways is an accomplished fact. Spindles are being subjected to an extra-fine grinding operation that gives a surface comparable to the best in automotive practice. Considerably longer life is expected to result. Semi-automatic and full-automatic machines that put the work in place, perform the operation, and pass the finished piece on to the next machine are coming into the grinding field. Better splash guarding keeps the neighborhood of the grinding machine much more attractive.

The situation in the shaper field seems to be parallel to that existing in the planer field a couple of years back when everybody brought out a radically new machine. At least three new shapers will be announced at Cleveland. They have decidedly interesting features.

Relatively little information on milling machines has reached us. Milling machine builders, in adopting the standard spindle end and arbors last spring, took a big step forward. Undoubtedly other advances in design will be evident. One manufacturer is to introduce a machine designed on a new principle, called by him, for lack of a better name, "offset" milling.

One of the unusual machines to be shown is a push-broaching machine designed to handle jobs that are usually milled. Another is a center-drive lathe for finishing both ends of automobile crankshafts at one setting. Other new lathes are notable for the application of power rapid traverse. One turret lathe has an ingenious hydraulic chuck-operating device actuated by the coolant pump and using the coolant as the liquid medium.

NO ATTEMPT has been made to secure advance information on the new things in accessory equipment of all kinds, welding machines, small tools, measuring instruments, etc., that will be shown at Cleveland or at Detroit during Show Week but they are none the less important. Lack of space and the magnitude of the task together make it impossible. And machine tools, after all, are the basic production tools of the metal working plant. What their designers evolve is of vital interest to production men and machine designers alike throughout the industry.

In conclusion, it may be worth while to sum up the more important design trends, as follows:

(1) Greatly extended use of anti-friction bearings.
(2) Provision for automatic lubrication.
(3) Application of hydraulic feeds.
(4) Built-in handling devices.
(5) Simpler, more convenient controls.
(6) More functions performed by power.
(7) Increased strength and speed of operation.

Shop Equipment News

THERE is being introduced at the expositions in Cleveland and Detroit an unprecedented quantity of new shop equipment. Practically all of the machines, tools, and other kinds of equipment described in the following pages are being shown for the first time at one or the other of these expositions, or both, as either new or improved design

Oesterlein 48-Inch Tilted Offset Miller

FOR the milling of small parts by a process known as offset milling, the Oesterlein Machine Co., Cincinnati, Ohio, has produced the 48-in. tilted offset miller shown in the accompanying illustrations. Such operations as face or straddle milling of small parts, the milling of flats, slots and saw cuts may be advantageously applied to offset milling on a high-production basis. Increased production with the offset process is due to the fact that a number of parts are under cut simultaneously all of the time, and that more than 90 deg. of the cutter is active at one time.

The front and side views of the offset miller can be seen in Figs. 1 and 2. Fig. 2 shows the driving side of the machine with the gear covers removed to indicate the speed change and pick-off gears. In general the machine consists of a tilted circular table in which there is a large center hole, and a spindle mounted beneath and at right angles to the working surface of the table. A 4-in. offset adjustment is provided for the table so that the center line of the table and the spindle may coincide for the removal of the circular or hollow-circular work holding fixtures or the centerline may be offset the distance required to obtain the proper depth of cut.

The spindle is mounted in a slide that is bolted to the same housing that carries the table, thus confining the strains of the cut within a single, completely-inclosed, reinforced ring of metal. This same housing that carries the table and spindle also carries the arbor support that forms an outboard bearing for the arbor. A vertical adjustment for the spindle is provided so that the final setting of the cutters in relation to the work can be obtained. The spindle adjustment and the spindle housing clamps are operated from the front of the machine. A 2-in., vertical adjustment can be obtained.

In Fig. 3 is shown the spindle mounting, which is of unusually heavy construction. The large Timken bearing is 8½ in. outside diameter. The spindle is driven by a wormwheel of 15 in. pitch diameter which floats on the spindle. It is carried on the bronze bearing shown. The purpose of mounting the spindle below the table is to bring the drive as close as possible to the nose of the spindle and to permit the removal of arbors or cutters without disturbing the vertical setting. A standard milling machine spindle end is used.

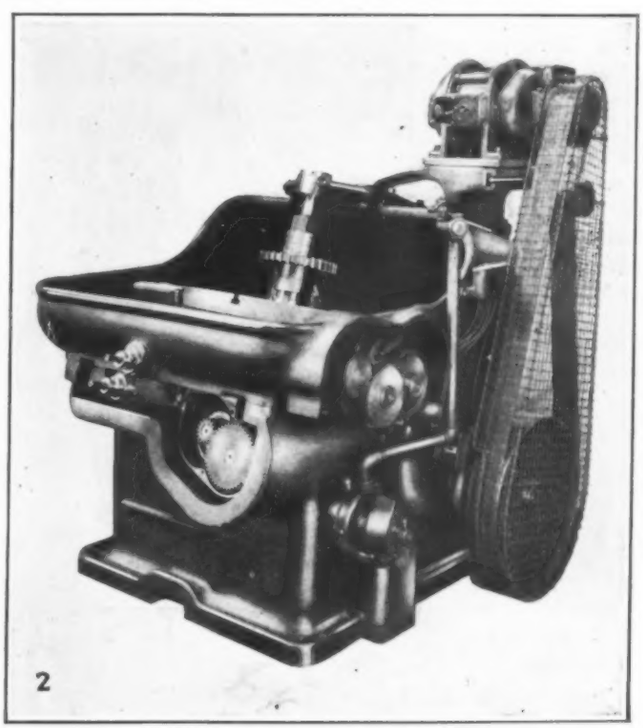
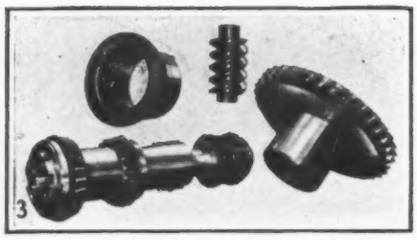


Fig. 1—Oesterlein 48-Inch Tilted Offset Miller. Fig. 2—Driving side of the machine with pick-off gears exposed



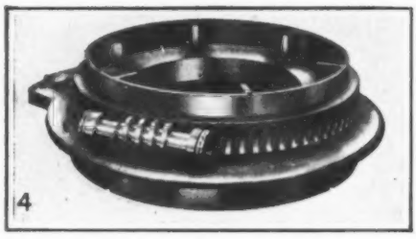


Fig. 3—Spindle mounting. Fig. 4—Table and drive in inverted position

In Fig. 4 the table unit is shown in an inverted position. The makers call attention to the fact that the worm and wormwheel are located as close as practical to the working surface of the table and that the wormwheel is practically as large in diameter as the table in order to provide ample driving power. The table is 30 in. in diameter and is mounted in a tilted position in order to shed the 40 gal. per min. of coolant without splashing outward and to wash away the chips so that they do not accumulate on the table or fixture. The chips are washed from the table into a retaining cavity in the base of the machine from which they may be shoveled out. The coolant drains from the chips through a strainer into a reservoir that connects with the centrifugal coolant pump which may be seen on the driving side of the machine in Fig. 2. A 10-hp. motor is recommended to drive the machine to its full capacity. The unit occupies 25 sq.ft. of floor space and its net weight is 7,000 lb., approximately.

"Footburt" Broaching Machine

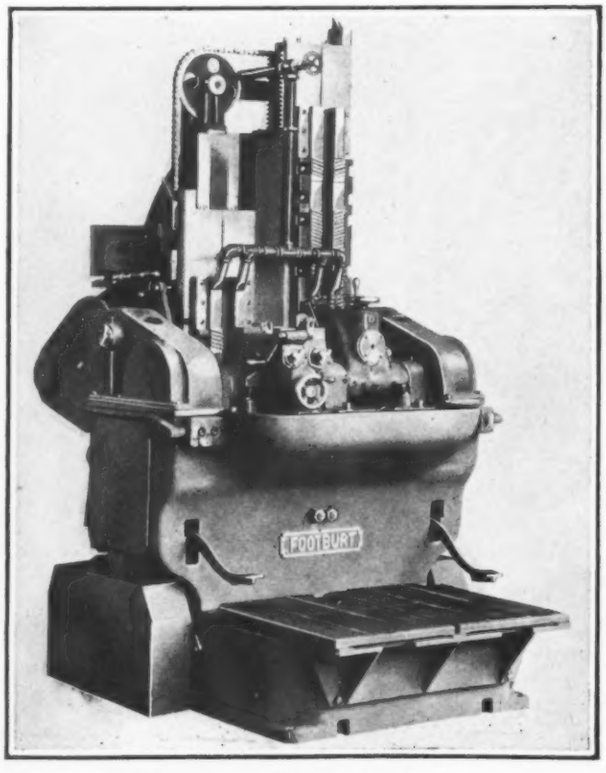
THE Foote-Burt Co., Cleveland, Ohio, has developed the broaching machine illustrated which is intended for finishing flat or irregularly-shaped surfaces. The machine is arranged so that one or more surfaces can be rough and finish broached in one operation.

The machine body consists of a cast-iron base with two uprights on which are mounted slides. On the slides are attached cases that hold the broaches. In operation, the slides travel alternately up and down on the ways of the uprights. The drive is taken directly from the motor through one set of spur gears and one set of bevel gears to the driving pinion. The pinion is located between the uprights and is in mesh with hardened steel racks mounted on the slides. The slides counterbalance each other and as one moves up the other moves down, operating continuously at a speed predetermined by the nature of the work. Dogs on the left-hand slide operate a lever that controls the switch, governing the reversing of the motor. A 17-hp. elevator-type reversing motor is used.

A tip-up fixture for holding the part to be machined is positioned in front of each slide. When the slide is at the bottom of the stroke, the fixture is in a horizontal position and the piece to be machined is placed in it while the slide is ascending. As soon as the piece is in place, a lever is tripped so that the fixture is automatically brought to an upright position, providing, of course, that the tripping has taken place before the slide reaches the top of the stroke. The slide then moves down and the piece is broached, after which the fixture is thrown back automatically to the horizontal position for reloading. One operator can handle the loading and unloading of the fixture.

The lower teeth of the broach do the roughing and the upper teeth are arranged to make the lighter cuts. In certain cases the parts to be machined are merely placed in position in the fixture, without clamping them. When this arrangement is used, a trip lever is operated so that when the fixture is tipped, the piece is automatically clamped in place. Likewise, when the fixture is thrown back to the horizontal position, the piece is released and may be removed. The trip lever can be arranged to act as a safeguard so that it cannot be operated unless a piece is in the proper position. The same mechanism is arranged so that the fixture will not be raised to the cutting position unless the trip lever is operated before the slide reaches the top of the stroke.

Coolant is used on all broaching work, the entire base of the machine being used as a lubricant tank and having a capacity of 60 gal. The pump delivers the coolant to the work at a rate of 40 gal. per min. It is claimed that a smooth finish held to close limits can be obtained at a high rate of output.

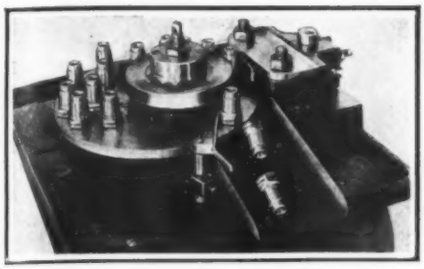


"Footburt" Broaching Machine

Noble & Westbrook Marking Machine No. 25

The Noble & Westbrook Mfg. Co., Hartford, Conn., has designed the rapid-production marking machine shown in the illustration for marking such parts as spark plugs, screw machine products, round bushings, and similar articles with a sufficient body to be marked without being crushed.

The machine is claimed to be of heavier construction and of greater capacity than the production machines previously marketed by this company. The working parts of the machine consist of a central dial acting as a pressure dial, which rotates and carries the work across the lettering die. The loading table which carries the work forward to the marking posi-



Noble & Westbrook Marking Machine No. 25

tion revolves slower than the pressure dial, giving ample time for the operator to load it. The work is placed in any convenient position on the carrying dial, which automatically brings the parts into position as it revolves. After being marked, the parts are unloaded automatically.

The essential moving parts of the machine are of hardened and ground steel, insuring long life. The lettering die is mounted in a die-holder, which can be raised and lowered in order to secure the marks on the proper place on the work. The pressure dial can also be raised and lowered to correspond with the die. The machine is claimed to have a production capacity for marking 125 pieces per min. A ¼-hp. motor is part of the equipment of the machine. The weight of the machine is 425 pounds.

Gisholt 2L Heavy-Duty Turret Lathe

THE Gisholt Machine Co., Madison, Wis., has brought out a universal-type turret lathe, designated as type 2L, having a square turret on the side carriage, and a cross-feeding hexagon turret on the rear carriage. A fixed center turret is furnished as optional equipment.

The machine is designed to accommodate medium-sized work, such as bar work, up to 3½ in. in diam. and 40 in. in length, and chucking work up to 16 in. in diam. It has a rigidly constructed bed and has the headstock walls carried above the spindle and back shaft bearings, so that no gearing is carried in the covers. The power is transmitted from a single-pulley drive through a multiple-disk friction clutch made of bronze and saw-steel plates, running in oil, through a train of hardened alloy-steel gears. Speed changes are accomplished by means of sliding gears on splined shafts. The spindle is mounted in cylindrical babbit bearings, carried in tapered cast-iron shells for adjustment and the spindle thrust is taken on a large ball bearing against the housing. All other shafts in the machine transmitting power, including those in the apron, are mounted on ball bearings.

A rapid traverse is provided for the longitudinal movement of the side carriage and of the turret carriage, also a rapid traverse for the in-and-out movement of the square turret on the cross slide.

The flat ways of the machine are covered with hardened steel plates and lubrication is obtained by force feed through the bottom of the two slides. The headstock and the spindle bearings are lubricated by splash, and the traverse and feed works are lubricated by oil under pressure.

The machine is driven by a 10-hp. motor operating at 1,200 r.p.m. connected by means of either a V belt, flat leather belt or silent chain. The driving pulley measures 15 in. in diam. and is operated at a speed of 500 r.p.m. A lead-screw thread-cutting device is furnished whenever the work requires thread chasing, and a taper attachment is located in the side carriage or may be attached to the cross feeding turret carriage.

The principal specifications of the machine are:

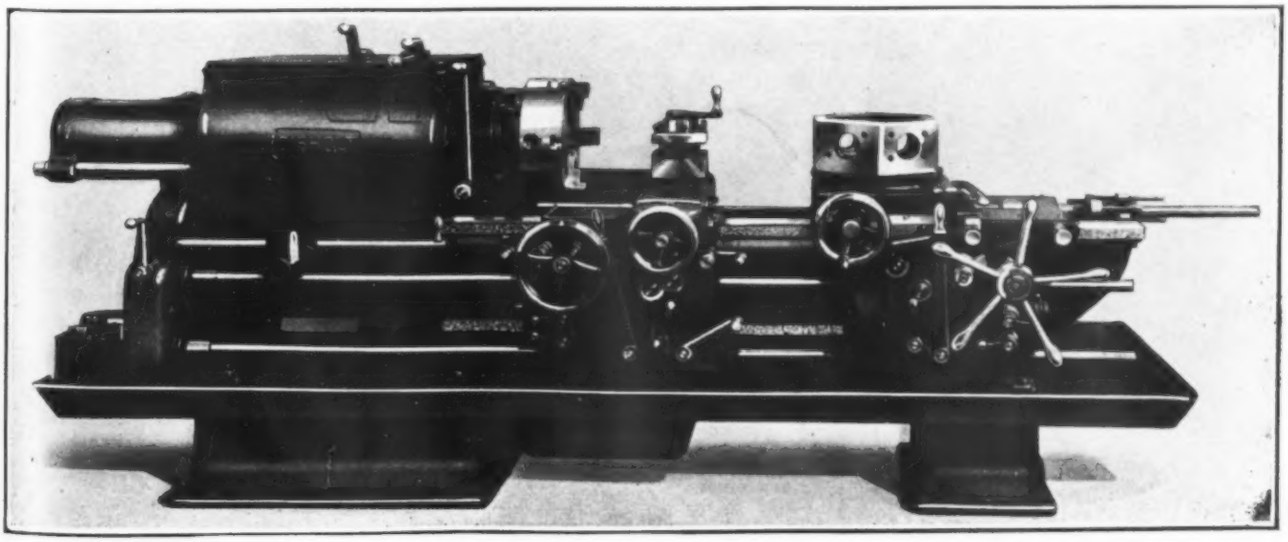
Swing over ways, in.	19
Swing over side carriage, in.	16½
Diameter of chuck, in.	16
Maximum distance, face of turret to end of spindle nose, in.	41½
Hole through spindle, in.	3⅞
Spindle speeds, 12 forward and reverse, r.p.m.	12 to 300
Longitudinal travel of hexagon turret, in.	36
Cross travel of hexagon turret, in.	7½
Longitudinal travel of side carriage, in.	36
Cross travel of side carriage, in.	11
Width of bed across ways, in.	15
Number of feeds—	
16 longitudinal, in. per rev.	0.004 to 0.168
16 cross	0.002 to 0.084

The machine occupies a floor space of 45 x 128 in. and the net weight is approximately 7,200 pounds.

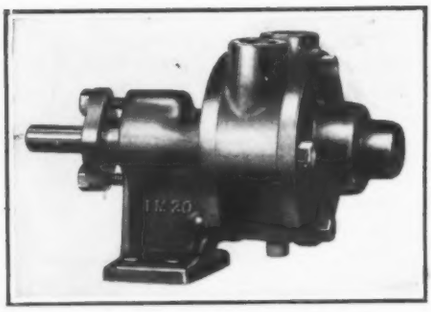
Tuthill Reversible Coolant Pump

The Tuthill Pump Co., 131 W. 63d St., Chicago, Ill., announces a line of reversing pumps, designed to operate without the use of check valves to obtain the reversing feature. With the Model R pump, illustrated, it is claimed to be possible to reverse the direction of rotation and still maintain a constant direction of flow.

The reversing feature of the pump is accomplished with the addition of



Gisholt 2L Heavy-Duty Turret Lathe

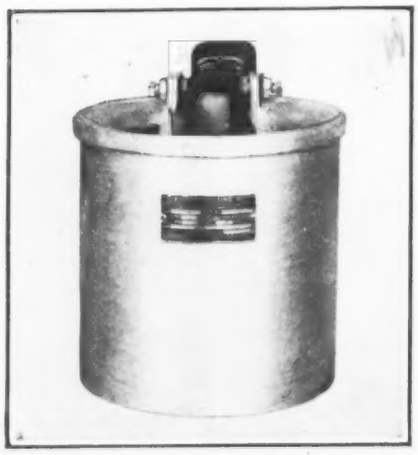


Tuthill Reversible Coolant Pump

only three parts to the standard machine-tool pump made by the company. This is accomplished by mounting an idler on a pin which is pressed into the idler carrier. This idler carrier is mounted in the cover and constructed so that it can revolve only 180 deg. A small spring presses the idler carrier against the revolving rotor, and this creates sufficient friction to rotate the idler carrier 180 deg. when the direction of rotation is reversed.

General Electric Small-Capacity Melting Pot

An electric melting pot of small capacity has been placed on the market by the General Electric Co., Schenectady, N. Y., for melting solder, lead, babbitt or tin, with capacity of 27 to 40 lb., according to the metal to be melted. This pot may be operated on either 110- or 220-volt



General Electric Small-Capacity Melting Pot

alternating or direct-current circuits, and is made in 750 and 1,000 watt ratings.

The melting pot consists of a sheet steel cylindrical casing 10 in. deep and 9 in. in diam., in which is supported a cast-iron crucible 4 in. deep and 6 in. in diam. The space between the crucible is insulated with a compact heat insulator. The heating units are of the cast-in, sheath-wire type. One unit is used in each pot. The leads of the unit are brought over the top of the pot into a connection box fixed to the unit. The pot is designed for melting metals at temperatures not exceeding 950 deg. F.

Société Genevoise Improved Jig Borer

THE locating and jig boring machine illustrated has been placed on the market by the Société Genevoise d'Instruments de Physique, Geneva, Switzerland, and is being marketed in the United States and Canada by the R. Y. Ferner Co., Investment Bldg., Washington, D. C.

The machine is claimed to be unique in that it has three spindles and performs work in all the three co-ordinates of length, width, and height. Notwithstanding the added complication of two additional tool slides and spindles, it is said to be operated with the same facility and speed as the more simple models, since the same principles of measurement and drive are used as in the other machines. Another feature of the machine is that it is so designed to permit the boring of three holes in the same plane simultaneously, the direction of one being at right angles to the other two, while the second and third holes may be from opposite directions in the same straight line. Because of this feature, the machine is obviously especially adapted to the construction of box jigs or fixtures in which alignment of holes on opposite sides is called for, together with holes on top of the box. The type of construction used in the former models of jig borers is employed. The bed of the machine has a rectangular table 51x28 in., mounted on a flat and a V-shaped way, which eliminates all play. Two upright pillars, one at each side of the table, support a cross-rail which can be raised or lowered through a range of 25 in. A slide on this cross-rail carries the vertical spindle, and has a cross motion of 28 inches.

The uprights of the machine are heavier than in the other models, since they each carry one of the horizontal spindles. These horizontal spindles are moved by accurate micrometer screws through 30 in. These screws are provided with automatic compensating devices for eliminating the small errors of the screws.

The maximum height of the vertical boring head above the table is 30 in., while that of the horizontal boring head is 24 in. The horizontal boring head can thus be lowered completely below the surface of the table, permitting use of the full space of 35½ in. between the vertical stands for large flat work when using the machine as a 2-co-ordinate machine. With the facilities provided, the work can be reset accurately on the machine so that the normal capacity of the machine can be greatly exceeded. The facilities provided for lining up the work consist of a microscope to mount in the spindle, a reference square for measurements from

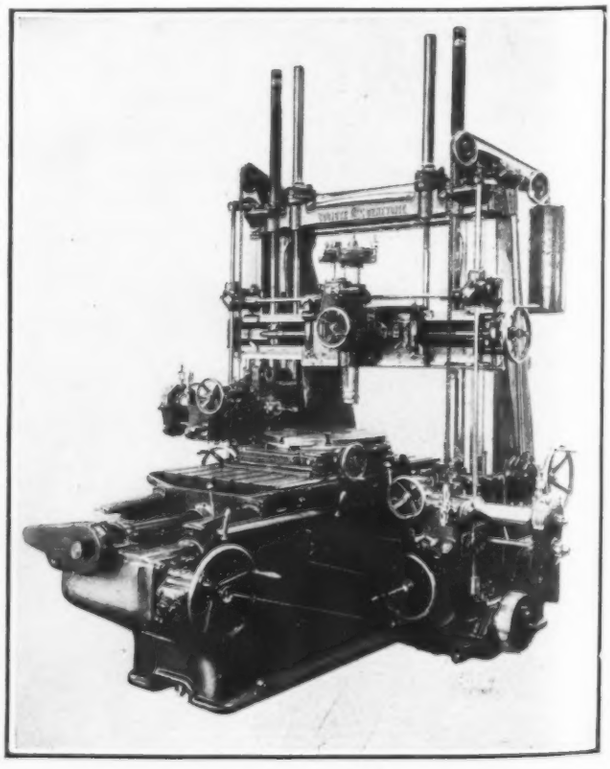


Fig. 1—Société Genevoise Improved Jig Borer

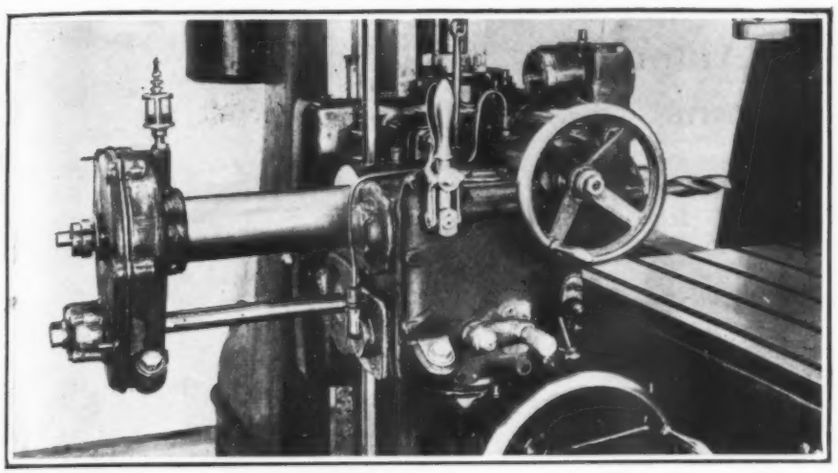


Fig. 2—Side view of the machine

the edge of a workpiece, a dial indicator device, and a semi-automatic precision center punch. All parts of the machine, such as T-slots, edges of the ways, and table tops, have been constructed with a high degree of accuracy and parallelism. The degree of flatness and parallelism is within 0.0004 in. in the whole 40-in. range of motion of the table. All micrometer drums can be read by the verniers to 0.00005 in. Four scales, graduated to tenths of inches, are used to read the intervals.

Great accuracy in the roundness of holes bored on the machine is made possible by the construction of the boring head. The spindles are of case-hardened steel, provided with devices for taking up axial play. They are fitted with No. 4 Morse tapers. The driving parts are located in an oil bath. Two speeds of feed are provided, one for drilling and one for boring. The feed may be by hand or power, the power feed being in both directions.

A 9-speed gear box, driven by a single pulley, gives rotation speeds to the spindles varying from 40 to 300 r.p.m. Provision is made at the rear of the machine for the attachment of a 3-hp. motor, or for two pulleys for transmitting an overhead belt drive.

A special circular table has also been designed for this machine, of 23½ in. diam., and having a graduated drum and vernier reading to 1 sec. of arc. This table makes the machine useful on work in polar co-ordinates. The maximum diameters that may be drilled with the machine are 1¼ in. in soft steel, or 1¾ in. in cast iron. The maximum diameter for boring is 6 in., while depths of holes up to 12 in. are possible. The machine is 7½x9 ft. by 10¼ ft. high. Its net weight is 13,000 pounds.

Cochrane-Bly Improved No. 66 Metal-Sawing Machine

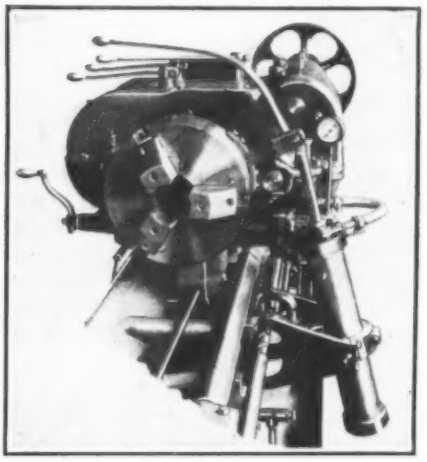
An improved metal sawing machine, giving three cutting speeds of 45, 60 and 75 ft. per min., has been brought out by the Cochrane-Bly Co., Rochester, N. Y. The speed changes are made by means of sliding gears which are made of hardened nickel steel. The machine has a back gear shaft mounting the worm fully inclosed in the carriage with the worm gear and spur drive gear.

The drive shaft runs in ring oiling bearings, and the friction clutch hub is provided with a self-oiling bushing. The machine is provided with a range of feeds from ¾ in. up to about 9 in. per minute. In other respects the construction of the machine is standard.

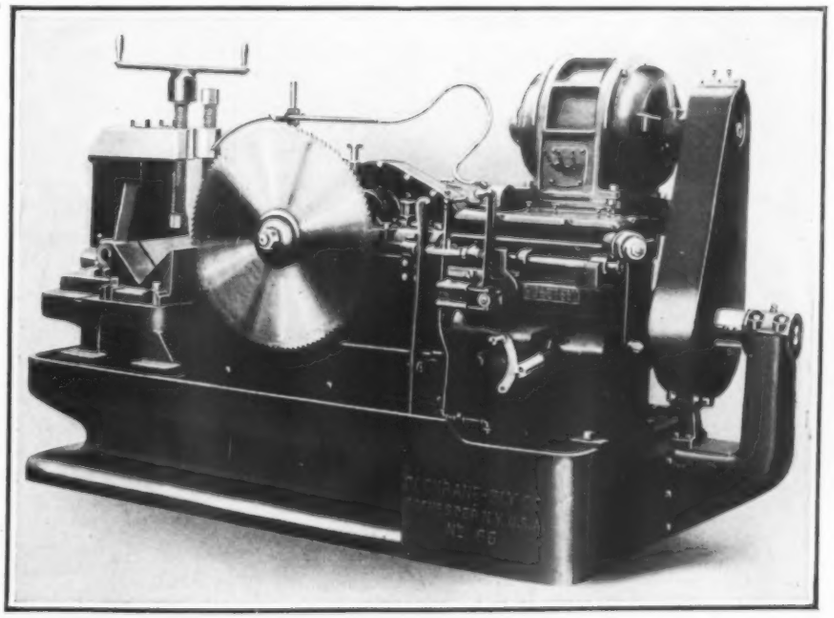
Foster Hydraulically-Operated Chuck for Turret Lathe

The Foster Machine Co., Elkhart, Ind., has brought out a hydraulically-operated mechanism for opening and closing the Foster-Barker wrenchless chuck. The mechanism is intended for installation on the Foster 3-B universal turret lathe.

The mechanism is entirely operated from pressure supplied by the lubricant pump installed for pumping coolant to the cutting tool. The mechanism is piped directly with the coolant system, and the coolant is the medium applied as pressure in the operating cylinder. The action of the mechanism is controlled by a hand crank at the front of the machine, as can be seen.



Foster Hydraulic Chuck



Cochrane-Bly Improved No. 66 Metal Sawing Machine

Norton Type B Full-Automatic Grinding Machine

TO MEET the demand for high production of small parts, and to secure the accuracy and finish desired, the Norton Co., Worcester, Mass., has designed and built the 4x5-in. type B full-automatic grinding machine illustrated, to produce high-grade work at maximum efficiency.

The entire operation of the machine is automatic with a mechanical precision that assures uniformity in grinding action. It is claimed that this results in the production of highly uniform products with long wheel life and a low idle-time factor. With a capacity for diameters to 4 in. and length to 5 in. the machine covers a broad range. Concentricity of the ground surface with the hole or with other diameters on the piece, is assured by locating the work on centers.

The regular Norton 10-in. type D grinding wheel unit is used. It embodies the self-contained motor drive features, the type B spindle bearing construction and a forced feed lubricating system. The wheel feed is linked with the automatic controls and timed with the operating cycle. The front section of the machine is of new design. Positive gear drive and cam action control the cycle of operation from the automatic loading of the work on the live centers to its ejection when finished. The work revolution and rate of infeed of the wheel are timed to suit the conditions of each individual job. The length of dwell at each end of the cut can be changed to allow sizing and finishing to various requirements. Change gears provide the means of altering the length of the cycle, while an adjustable index stop permits of altering the dwell period.

Work is placed in a feeder and delivered between the driving centers by a mechanically-operated loader of the turret type. End pressure, adjusted for the requirements, drives the work, and, upon completion of the grinding cuts and dwell, the work centers are withdrawn to permit the turrets to take out the finished product and insert the next. All of the operations of the grinding cycle are co-ordinated and speeded through their mechanical operations to reduce lost time between cuts. The length of cycle can be adjusted to suit any operation on a wide variety of work.

The wheel truing device is in the wheel guard. It has a power driven traverse motion that results in the generation of a true and regular surface over the entire width of the wheel face. Formed surfaces may also be ground by truing the wheel face from a form bar in the truing device to control the path of the diamond. Because of the use of this fixture, and the positive wheel feed action obtained, the frequency of wheel truing is held to a minimum.

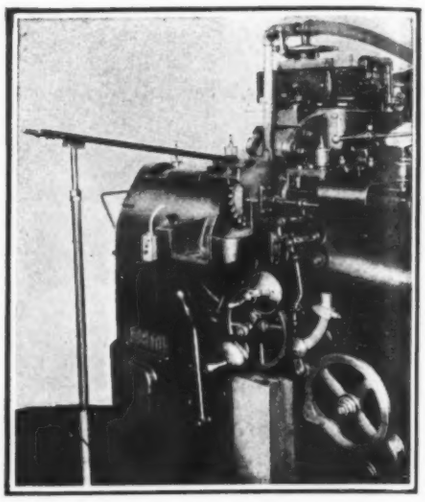


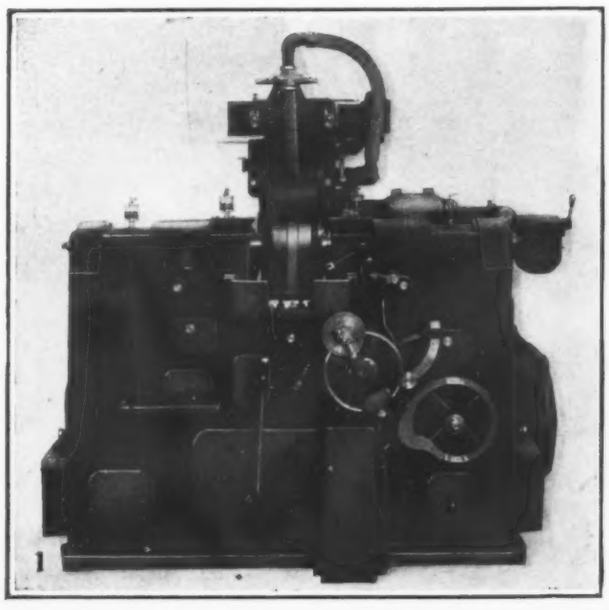
Fig. 3—Automatic feed device

Mechanical control duplicates the motions of a skilled operator, reduces loss of time in loading, and secures large production, it is said.

Universal, No. 24 "Tri-Way" Boring Machine

The Universal Boring Machine Co., Hudson, Mass., has placed on the market the heavy-duty, model No. 24, "Tri-Way" boring machine illustrated. The machine has been designed to meet the demand for greater vertical range, and to provide maximum boring and milling capacity when operated at the limit of travel.

The heavy duty No. 24 machine retains the essential features of the "Tri-Way" universal horizontal bor-



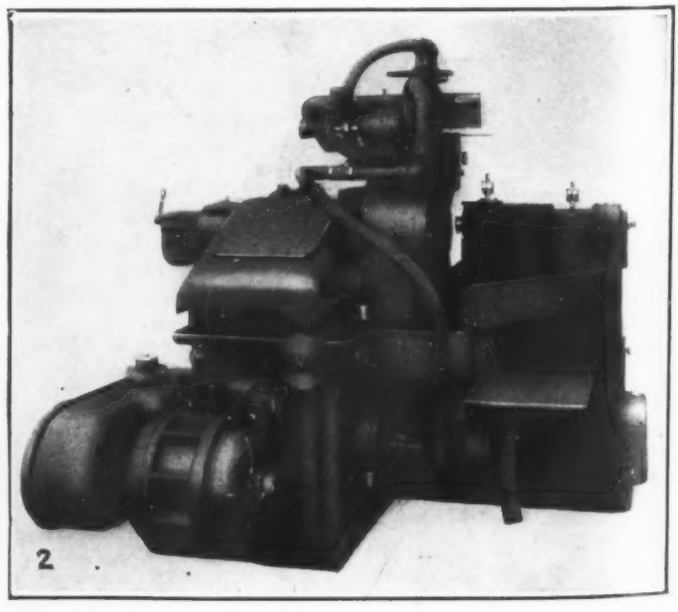
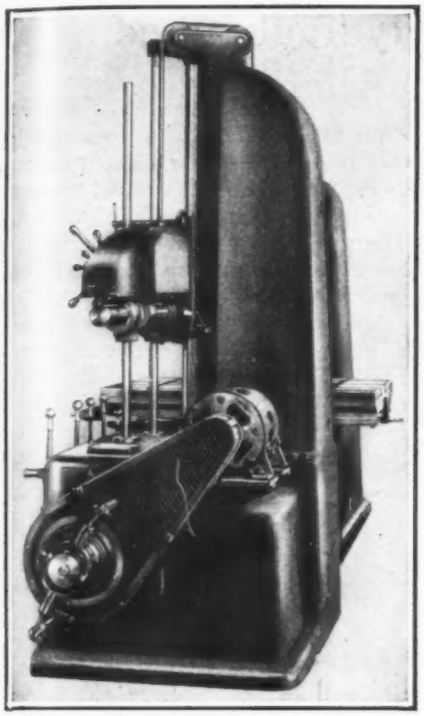


Fig. 1—Norton Type B Full-Automatic Grinding Machine, front view. Fig. 2—Rear view of the machine



Universal Heavy-Duty Tri-Way Boring Machine

ing machine previously described on page 44, Vol. 56, and page 402, Vol. 61, of the *American Machinist*, but increased capacity has been secured by complete re-design of the head and rear posts for greater strain. At the same time, the main driving clutch and the clutch for reversing the spindle have been increased in capacity to provide greater power. Other features of the machine requiring added strength have also been re-designed. The new design is offered in a variety of combinations of size of bed, vertical travel of head, and size of table, to meet the needs of individual manufacturing plants.

The heavy-duty machines are all equipped with 3-in. spindles, and vary in weight, according to dimensions, from 14,500 to 17,400 lb. The maximum specifications of the heavy-duty, No. 24, "TrivWay" boring machine are as follows: Distance from top of table to center of boring bar 40 in.; size of table 32 in. wide by 52 in. long; capacity to take 8-ft. between the face plate and the rear bearing.

Oliver Face-Mill Grinder

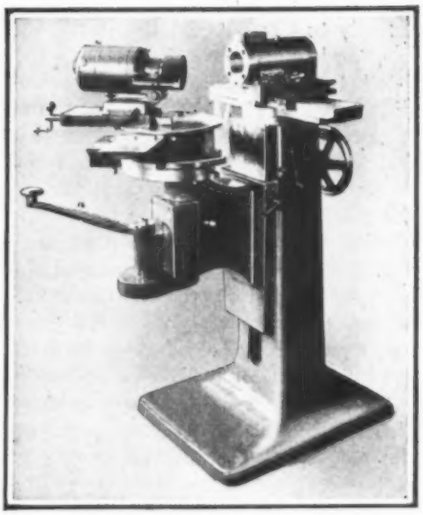
The Oliver Instrument Co., Adrian, Mich., has developed the face-mill grinder illustrated for grinding the face and periphery of the cutting blade at one pass of the wheel. The grinder also forms a circular corner, joining the face and periphery, so that the entire cutting edge is smooth and continuous. The machine is also adapted for grinding various other types of milling cutters and form tools, and for other grinding operations requiring a radial motion of the grinding wheel or a combination of straight and radial grinding.

The extent of arc is governed by the position of two cam plates beneath the motor slide. With the plates regularly furnished, the machine has a capacity of arc of 60 to 100 deg., but with special plates arcs from 0 to 180 deg. may be ground. The radius of curvature is determined by the distance of the grinding face of the wheel from the center of rotation, and this can be varied from 0 to about 2 inches.

The movement of the wheel carriage is by means of a single hand lever. The wheel carriage is automatically locked against any other movement than the one desired. It is possible to grind a face mill with a different clearance on the periphery than that ground on the face, and this clearance will automatically change while the grinding wheel is forming the round corner, so that the cutting edge is perfectly smooth.

The spindle is fitted with a standard milling machine spindle nose. The bearing has a transverse and longitudinal adjustment for cutters up to 18 in. in diam. and 6 in. thickness. The grinding wheel carriage is mounted on a knee having vertical adjustment, and it traverses a slide that is supported in a vertical bearing. The motor carriage is traversed by means of a rack and pinion operated by the hand lever. All wearing surfaces have been protected from emery.

The machine weighs 1,000 lb. approximately.

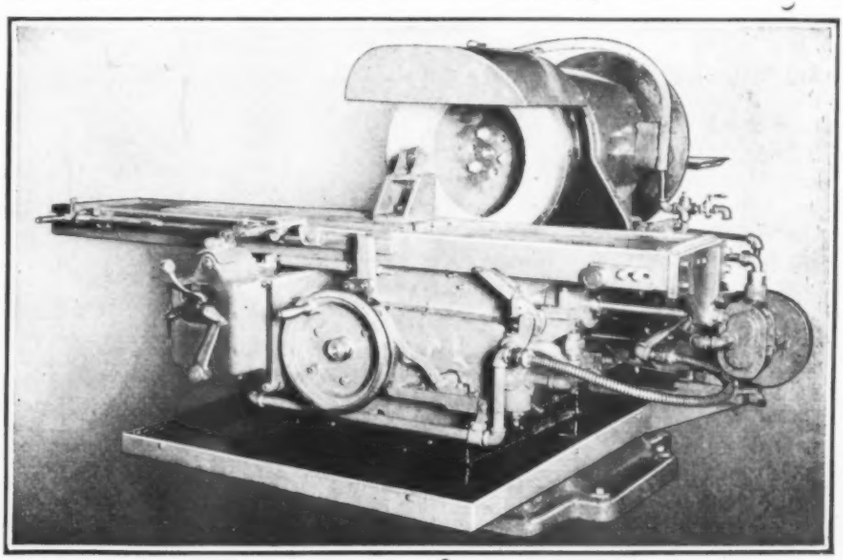


Oliver Face-Mill Grinder

Badger No. 8 Face Grinding Machine

The Badger Tool Co., Beloit, Wis., recently built the No. 8 face-grinding machine illustrated, which is equipped with a hydraulically-operated table. The machine is of the built-in type motor drive, a 15-hp. motor being used. The left end of the machine is fitted with a hand-operated lever feed table. The entire unit is fitted for wet grinding although the various drip pans and guards have been removed to show the construction satisfactorily.

The grinding table consists of two



Badger No. 8 Face Grinding Machine

main castings, a compound slide fitted directly to the knee of the base casting, and a reciprocating table top fitted to the top of the compound slide. A brass cylinder with a piston is fastened within the compound slide and the outer end of the piston rod is connected to a block attached to the rear end of the table top. The control box containing the necessary valves is mounted to the front of the compound slide convenient to the operator. Adjacent to it is the automatic ratchet infeed having a large graduated handwheel.

The oil pump is driven by a silent chain through a separate 1-hp. motor, the unit being mounted on a bracket at the rear of the machine. A ¾-in. pipe and flexible steel hose make the connections between the pump, the control box, the cylinder and the oil reservoir, the latter being part of the machine base. Adjustable stop dogs are locked in a T-slot along the front side of the table top and may be set for any stroke ranging from 1 to 32 in. in length.

The direction lever being the upper one in the control box has three-positions, a forward, a reverse and a neutral. It is instantaneous in its action. The hand lever is directly connected to a hardened steel pawl, shown at the extreme top of the control box. For automatic control this pawl comes in contact with the stop dogs locked on the side of the table top.

The lower lever shown on the control box is used for speed regulations. By shifting the lever in either direction the travel of the table top will increase or diminish. This adjustment can be made in any position of the table, and even while grinding is in process. For example, if a long casting is to be ground where there is a 2-in. square pad near each end of the casting but these pads are 20-in. apart, the table may be slowed down while the first pad is in actual contact with the wheel and then speeded up until it reaches the second pad, after which the table can be slowed down instantly to the proper grinding speed. Besides allowing the selection of correct grinding conditions where a uniform speed is required, it is claimed this speed regulator results in greater production when unusual conditions are met.

The face grinding table has no vertical adjustment. Work-holding fixtures are built at the proper height to bring the center of the work to be ground up to the center of the grinding wheel. Auxiliary table tops of different heights can be furnished.

Natco 4-Inch Hydraulic-Feed Drilling Unit

A HIGH-SPEED hydraulically-operated drilling unit known as the 4-in. sliding-head type, has been placed on the market by the National Automatic Tool Co., Richmond, Ind. When attached to a supply pump, the unit, with the motor and the spindle box, is a complete drilling machine, having individual feed-control valves operated by adjustable trip dogs which completely control the head movements. The cycle of the unit, automatic in operation, consists of rapid traverse forward, slow feed, rapid return, and stop. The hydraulic cylinder is cast in the the head slide, and the feeding pressure for both the forward and the reverse strokes enters through the center of the piston shaft. This construction reduces the overall length to 44 in. The width of the machine is 15¼ in. and the height is approximately 24 in. over the top of the motor. The maximum head travel of 11 in. need only be used when necessary as the travel and the feed can be limited to the requirements of the work by the adjustable trip dogs. It is claimed the unit will drive two 1-in. drills at a feed of 0.01 in. per min. in cast iron, while the feeding rate can be set from 0 up to the rapid traverse rate of approximately 75 in. per min. The weight of the unit is 700 lb. A 3-hp. motor is recommended for capacity drilling.

The unit may be arranged horizontally, vertically or at any angle desired. The three-way drilling machine illustrated in Fig. 2 has two horizontal and one vertical unit for the drilling of three sides of a trans-

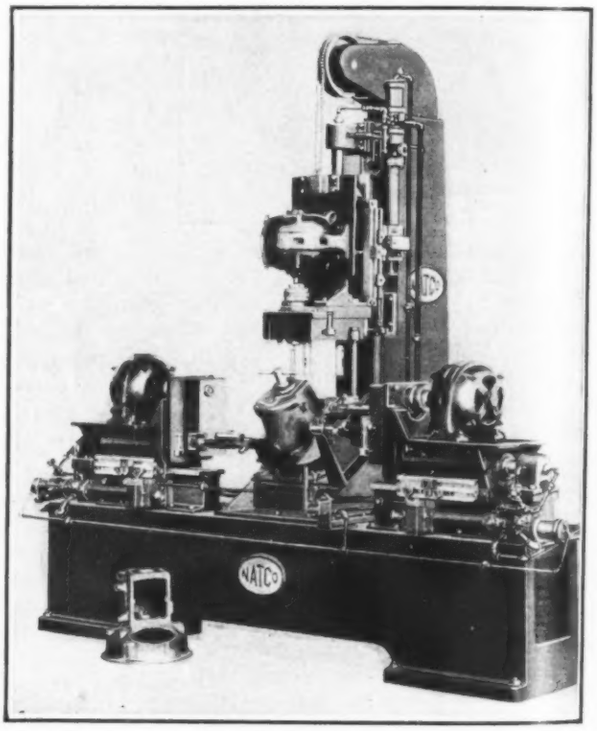


Fig. 2—Natco Drilling Machine equipped with three heads

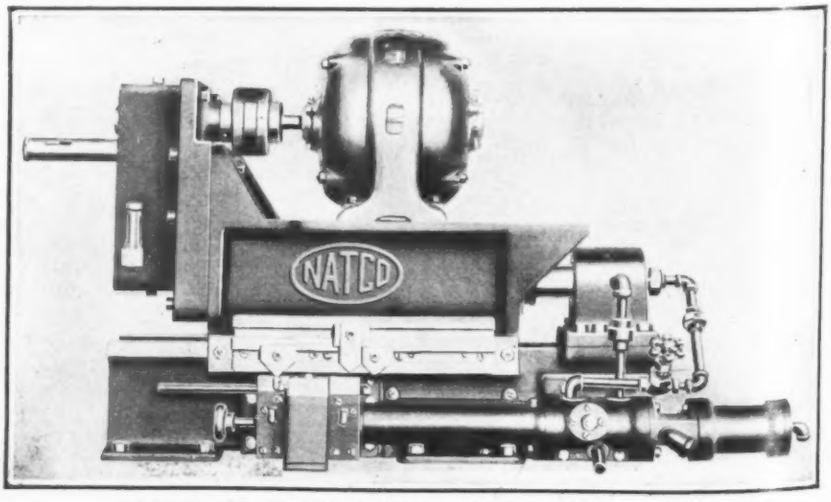


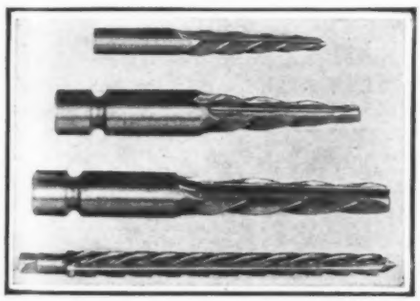
Fig. 1—Natco 4-Inch Hydraulic-Feed Drilling Unit

mission case. When the units are mounted in multiples, they are started simultaneously from a single vale positioned at the front of the machine, after which the units go through their complete cycles automatically. The starting valve also serves as an emergency reverse.

Gammons "Duplex" Taper Reamers

The Gammons-Holman Co., Manchester, Conn., has placed on the market a taper reamer to be known as the Gammons "Duplex." It will be made to order, in all except the very small sizes, up to 3 in. in diameter and of any desired taper. Standard Morse tapers and standard taper-pin reamers of this type are carried in stock.

As may be seen in the illustration, the reamer has a single, straight blade extending over its full length, while the remaining blades are dis-



Gammons "Duplex" Taper Reamers

posed in an interrupted helix of left-hand lead. The combination of straight and helical blades is claimed by the maker to result in a chatterless reamer, capable of producing exceptionally smooth holes.

The standard helix angle adopted is 52 deg. at a point midway of the length of the cutting portion. The angle decreases toward the large end and increases toward the small end in accordance with the degree of taper, the lead remaining uniform. The tool can be supplied with greater or less helix angle as desired.

The reamers are made for machine or hand use, with any size or shape of shank that may be ordered. Unless otherwise specified they will be made of high-speed steel. The larger sizes of reamers for machine use will have an oil-hole extending through the center, so that oil may be delivered under pressure at the point. This feature is of advantage in reaming blind holes, since the returning stream of oil will wash the chips out.

Hendey Improved 32-Inch Shaper

THE Hendey Machine Co., Torrington, Conn., has developed an improved model of its crank-shaper in the 32-in. size.

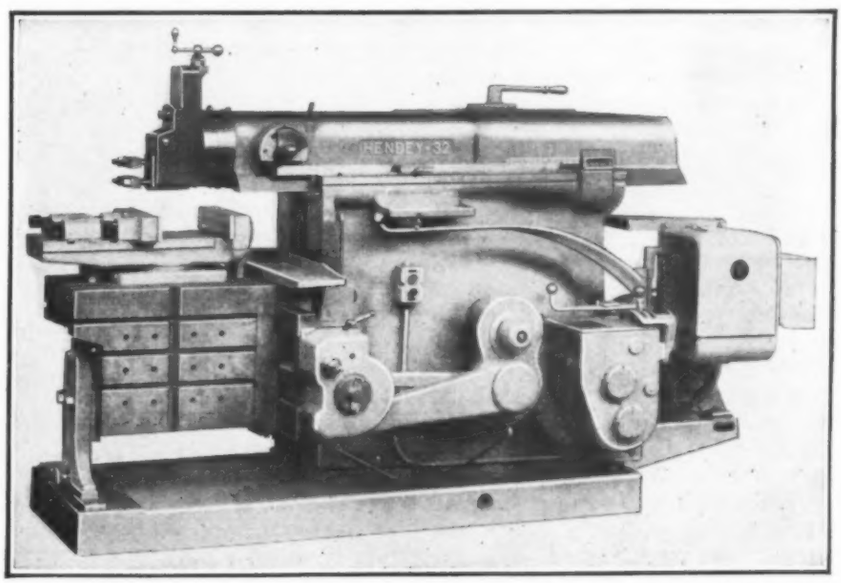
This machine is driven either by belt from an overhead lineshaft or by a motor attached to the base as here shown, through a single-speed shaft which passes through the base and terminates in a gear-box through which four speeds are available. The regular operating lever operates upon the same principle as the gear-shift lever of an automobile to select the desired speed. Through backgears, thrown into and out of engagement by another lever, the range of speeds obtainable through the gear-box is doubled; making eight speeds in all. The long lever shown actuates a clutch in the constant-speed pulley or sprocket to start and stop the machine. A safety latch, to be seen below the tool shelf, holds the clutch out of engagement.

The gear-box is of unit construction, so that by taking the pulley or sprocket off the opposite end of the shaft and withdrawing the holding bolts from the flange of the box the entire driving train can be removed intact, leaving only the bull gear in the cabinet. All rotating bearings of the machine are of either the roller or ball type, as the size of the bearing or severity of its service dictates, and all are lubricated automatically. A complete oiltight inclosure contains the bull gear, its pinion, and the back gearing, so that the entire train runs in oil.

The stroke of the ram is adjusted from zero to a maximum of 32¾ in. by means of the loose crank handle ordinarily used to operate the cross-feed screw. A locking device prevents the adjustment from shifting or being shifted, except when the crank handle is in place on the squared end of the shaft connecting with the screw. The action of placing and removing the crank handle automatically unlocks and locks the adjustment.

The cross feed movement of the saddle is derived primarily from the shaft of the bull gear through elliptic gearing and a fixed crankpin in the driven gear. The varying velocity of the driven elliptic gear exactly compensates for the corresponding variation of the crank-and-lever movement of the ram, so that the feed always takes place during, and occupies the full time of, the return stroke of the ram, regardless of the amplitude of either stroke or feed.

The crankpin in the elliptic gear transmits, through a connecting rod, an oscillating movement to a pawl lever at the end of the cross-rail. This lever pivots about an axis that is movable lengthwise of the lever by means of a double-crank handle at the end of the cross-rail, and thus the pawl moves through a greater or lesser arc according to the relative position of the fulcrum. By turning this crank-handle the amount of feed can be increased or diminished in increments of 0.010 in. per turn, and the amount for which it is set at all



Hendey Improved 32-inch Shaper

times is registered on a graduated dial. The range available is from 0.010 to 0.150 in. per stroke of the ram. The handle does not revolve with the machine, so that the setting may be made as readily and accurately while the machine is in motion or at rest. Feed is started and stopped and the direction reversed, by a lever on top of the casing. All of the feed mechanism is inclosed and is automatically oiled through a telescoping pipe and channels in the cross-rail.

At the bottom of the cabinet, below all working parts, is a reservoir to contain the lubricating oil. Used oil drains to this reservoir through a settling basin and is raised, by a constantly running geared pump driven from the hub of the main pulley or sprocket, through a filter and delivered to the distributor, which may be seen on the side of the ram-way. Four streams of oil, visible through the glass front of the distributor and capable of regulation by small screw valves, flow respectively to both sides of the ram-way, to the driving and speed-regulating mechansm, and to the feed gears and bearings at the end of the cross-rail.

Oil is delivered through a pipe attached to the main lever to lubricate the fulcrum pin of the latter, the main crankpin, the sliding block and the link pins that connect the upper end of the main lever to the ram. By this automatic oiling system all rotating and sliding bearings of the machine are lubricated except the main driving pulley (which is provided with a grease cup), the cross-rail, the elevating screw and the tool-slide. The pump, filter and connections are inside the cabinet and are in no way disturbed by the removal of the speed-change gear-box unit.

A positive outboard support is provided for the table. The supporting member carries a rack having buttressed, or ratchet, teeth, that is capable of a limited vertical adjustment by means of a wedge and the knurled-head screw to be seen at the bottom of the support. A short section of the same type of rack, inverted with respect to its teeth, is secured to the adjoining face of the table. After the cross-rail has been adjusted to the desired height, these too racks are brought into engagement with each other and the sliding rack raised by its wedge until the opposed teeth are firmly in contact; after which the binding bolts are tightened.

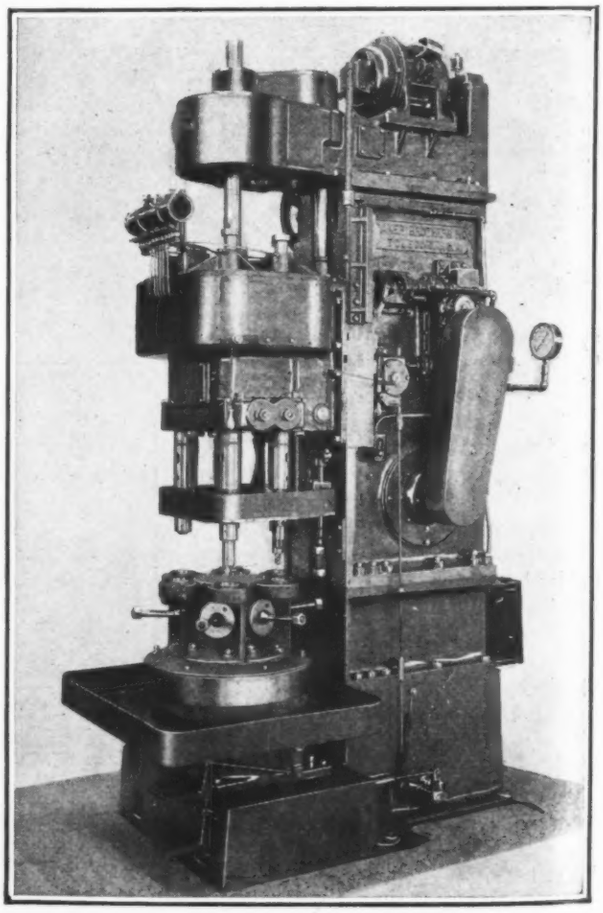
The box table has an upper surface of 32 x 19 in. Planed T-slots and reamed stop holes are in all sides of the table, and there are also T-slots in the face of the saddle. A single floating elevating screw adjusts the height of the cross-rail, which is gibbed to the inner sides of the vertical guideway.

The tool slide is provided with a power down-feed, adjustable in increments of 0.001 in. by swinging a graduated sector and engaged by pulling the knob on the axis about which the sector swings. The head is adjustable to any angle in a vertical plane, and is ordinarily clamped to the face of the ram by two wedge binders located 120 deg. apart. A third binder at the bottom of the head is employed when draw-cuts are to be taken and extra rigidity as nearly as possible in the line of strain is desirable. Bolts and straps are employed instead of the usual tool-post, and the capacity is for a 2-in. square-section tool shank.

The vise swivels to all angles in a horizontal plane and is graduated to 180 deg. The jaws are $3\frac{1}{4}$ in. deep. The movable jaw is of the quick-adjustment type, with two screws. The shaper will plane work $32\frac{3}{4}$ in. long by 34 in. wide by $19\frac{1}{2}$ in. high. It occupies a floor space of 11 x 5 ft. and weighs approximately 10,600 pounds.

Baker No. 25-H Hydraulic-Feed Boring and Drilling Machine

BAKER BROTHERS., INC., Toledo, Ohio, is marketing the No. 25H hydraulic feed boring and drilling machine illustrated, which is a production type unit having a direct-gear motor drive for the operation of the spindles in the head, and an Oilgear hydraulically-operated feed mechanism. The machine is of the sliding saddle type and can be furnished as a single-spindle unit, or with multiple spindles for handling more than one piece at a time, or for successive operations on the same piece. It is especially adapted for work in connection with an indexing table. The heads carrying the spindles are made special depending upon the nature of the work to be machined. On the multiple-head type a vertical adjustment is provided for each spindle to compensate for variations in tool lengths resultant from grinding and wear. The heads are made with hardened alloy-steel gears mounted on ball bearings and are equipped with sight-feed oilers. The rate of feed for the setting operation is variable and can be changed easily by a lever located on the left-hand side. The Oilgear feed has a rapid traverse for lowering the head to any predetermined location, after which the cutting feed is engaged, and an automatic quick return. The feed is actuated by engaging a treadle located at the front of the machine. The points at which the



Baker No. 25H Hydraulic-Feed Boring and Drilling Machine

rapid traverse changes to the cutting feed, and the point at which the quick return functions are controlled by cams located on the saddle. Adjustment permits the cams to be changed to any position within the feed range.

The main motor drive is mounted on top of the machine, thus requiring no additional floor space, and placing the motor away from dirt and chips. The Oilgear pump installed inside the frame of the machine is driven by a 1½-hp. motor, which is located within the machine frame. Variations in height or clearance between the spindle and the base can be secured by means of spacer blocks.

The machine illustrated has a five-spindle head and a six-station table, one station of which is provided for chucking purposes. Each spindle performs an individual operation and a piece of work is completed at each cycle of the machine.

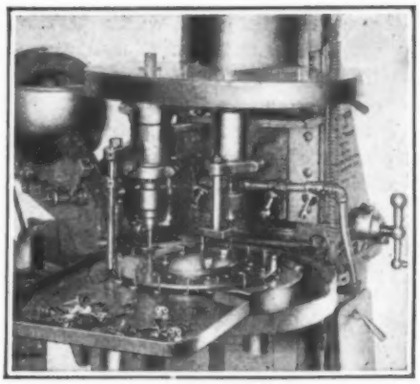


Fig. 2—Close-up of the automatic dial feed

Anderson Tapping Machine with Automatic Screw-Inserting and Staking Devices

MODIFICATIONS have been made to the dial-feed tapping machine made by the Anderson Die Machine Co., Bridgeport, Conn., so as to combine in one machine three distinct operations. In applying binding screws to electrical apparatus, it is necessary to tap the hole, insert the screw and rivet or stake over the end after inserting in order to prevent the screw from being entirely backed out when making the connection. Heretofore, such parts have been tapped in one operation, the screw inserted in another, and the end staked over in a third. These three operations have been combined in the dial-feed tapping machine shown in the illustrations by applying a hopper for feeding the screws automatically, a screwdriver for driving the screw to the desired tension, and an automatic staking tool. One, two or three holes, either in the same plane or different planes, can be handled in the machine at a speed of from 40 to 45 pieces completed per minute. The hopper is made to feed screws from Nos. 3 to 10 in size by a simple adjustment of the chute rails. The hopper is driven directly from the machine itself, and the screw is positively transferred from the chute rails into transfer fingers, which centralize the screw head with the screwdriver. These transfer fingers also carry the screw from the level of the chute rails into the tapped hole on a lower level.

The screwdriver is provided with a friction clutch device, by means of which the torque exerted by the screwdriver can be adjusted to suit the requirements. The bit which engages the slot together with the centralizing sleeve can be changed to suit heads of various diameters and shapes. It is claimed that the screwdriver will not burr holes in screws due to the friction clutch.

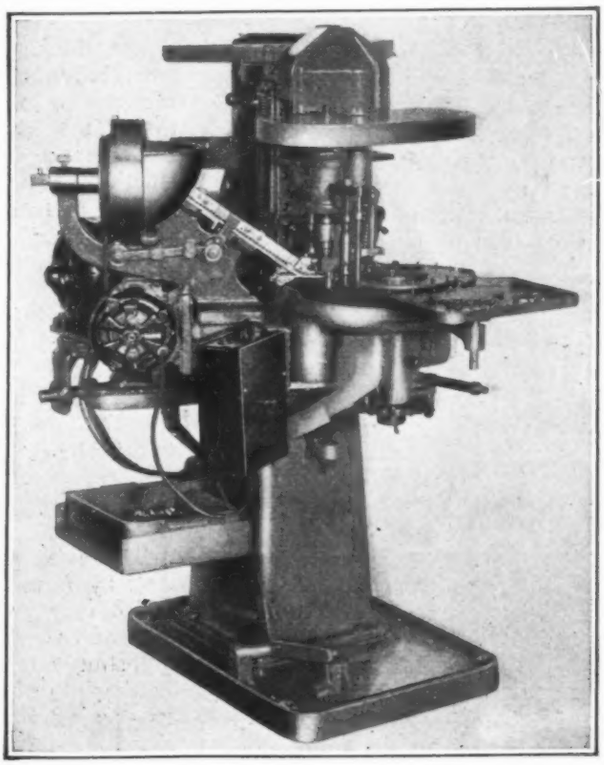


Fig. 1—Anderson Tapping Machine equipped with Automatic Screw-Inserting and Staking Devices

The staking tool is so constructed that the blow can be regulated as desired. It will give a uniform blow regardless of the variations in the length of screw. The work is automatically ejected from the dial upon completion of the operation. In Fig. 1 a general view of the machine is shown, while in Fig. 2 a close-up is shown of the dial feed. With this machine the operation is on contact blades for separable plug caps. A speed of 50 pieces per min. is obtained.

Bath Acme- and Square-Thread Ground Taps

John Bath & Co., Inc., Worcester, Mass., recently developed a line of ground taps with both square and Acme threads. It is claimed that by their use it is practicable to cut accurate threads in drilled or bored holes without preliminary lathe work.

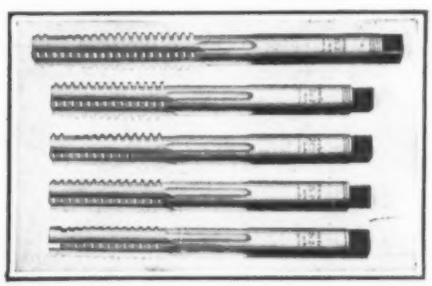


Fig. 1—Set of Bath Acme-Thread Taps

The taps are used in the same manner as ordinary hand taps.

The illustration, Fig. 1, shows a progressive set of taps to cut Acme threads. Study of the leading tap to the right of the row will disclose that the teeth are of rectangular shape and that alternate teeth are made with small recessed notches and projections at their outer ends. The teeth grow longer but not wider toward the

shank of the tap, the width at the top of the tooth always remaining less than that of the Acme form at a corresponding height.

The second tap continues the work of the first one. The teeth of the third tap begin to assume the angular shape of the Acme thread form toward their crests, but owing to the fact that the individual teeth are now following previously cut grooves of an entirely different shape the cut is broken up, thus lessening the strain on the tool and bringing out the material in the form of several narrow, curled shavings instead of one wide chip. The principle involved is similar to that where two parting tools are used simultaneously in a cutting-off machine, one tool being narrower and set to cut slightly in advance of its wider mate so that the metal is removed from the kerf in three chips.

The teeth of the fourth tap are again rectangular in shape toward the crest but merge into the Acme form at the root. The fifth tap is of full and true Acme form, tapering toward the entering end and terminating in a pilot portion the threads of which fit and follow the threads cut by the preceding taps. The pilot portion does not remove any metal, but merely acts as a guide and lead for the cutting portion of the tap.

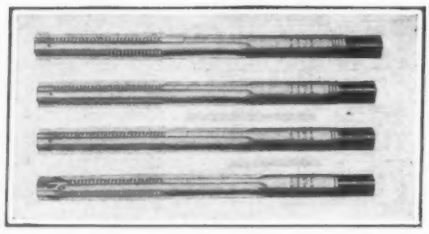


Fig. 2—Set of Bath Taps to Cut Square Threads

The square thread taps shown in Fig. 2 are designed to utilize the same principle of dividing the cut as uniformly as possible among the teeth of the full set of taps.

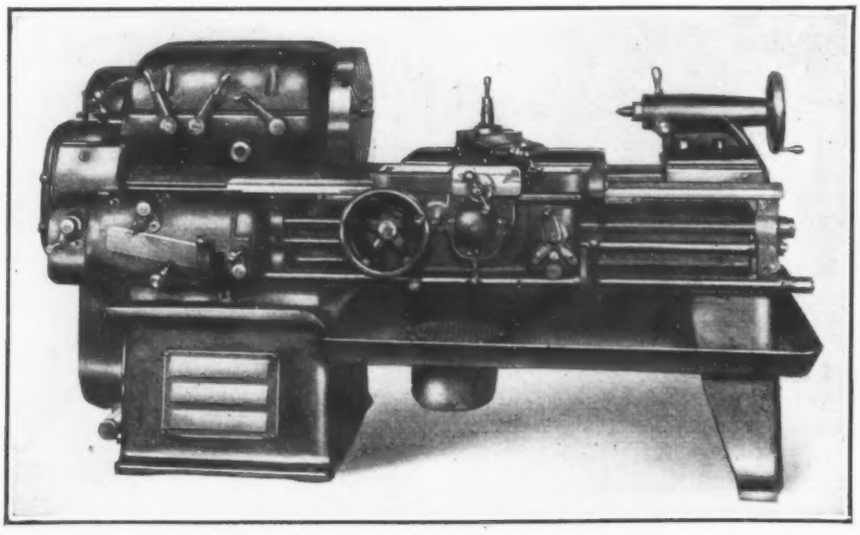
All taps made by this company are form-ground from solid metal after the blanks have been hardened and tempered, so as to eliminate errors due to distortion in those operations. Both square and Acme thread taps can be furnished in any commercial size and pitch down to $\frac{1}{4}$ in. in diameter. Acme taps 6 in. in diameter have been made.

Reed-Prentice 14-Inch Geared-Head Lathe

THE Reed-Prentice Corporation, Worcester, Mass., announces the 14-in. geared-head lathe illustrated, which is of the sliding gear type, and is intended for heavy-duty production work.

The geared head is constructed with nine gears operated by levers at the front of the headstock. The drive is accomplished by belt from a built-in motor mounted within the headend cabinet leg. An adjustable spring-idler is provided for proper belt tension.

Two levers are provided for friction start and stop, one located just beneath the headstock and the other at the right of the apron. The cross and the longitudinal feeds are operated by a single lever located in the apron. The tailstock has an improved type of binder and the carriage is arranged to accommodate a taper attachment. The machine is adaptable for additional attachments, including an oil pan, a pump and piping.



Reed-Prentice 14-Inch Geared-Head Lathe

The spindle, made of heat-treated chrome-nickel alloy steel, is mounted in bronze alloy bearings, the front bearing measuring $3\frac{1}{2}$x$5\frac{1}{2}$ in., and the rear $2\frac{3}{4}$x$4\frac{1}{4}$ in. The gears in the headstock and the quick change box are made of chrome-nickel steel, and the gears in the apron are made of high-carbon steel. The back shafts run on ball bearings and the lead screw is mounted on radial ball bearings having hardened steel and bronze washers for thrust.

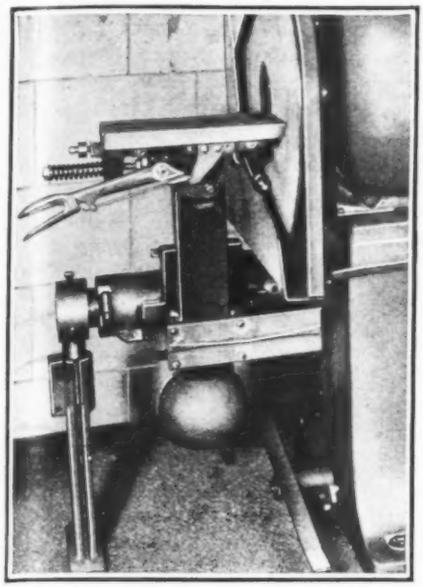
The specifications of the machine are:

Swing over bed, in.	16$\frac{1}{4}$
Swing over compound rest, in.	10
Distance between centers, 6-ft. bed, in.	30
Number of spindle speeds	8
Range of spindle speeds, r.p.m.	16.5 to 384
Number of feeds	55
Range of feeds, in. per rev.	0.0025 to 0.16
Number of thread sizes	55
Range of threads	2 to 128
Centers	No. 4 Morse Taper
Hole through spindle, in.	1$\frac{3}{8}$
Length of carriage, in.	25$\frac{1}{2}$
Motor size, hp.	3 or 5
Floor space; 6-ft. bed, in.	96x39$\frac{3}{4}$

Gardner Mechanically-Oscillating Work Table

The mechanically-oscillating work table shown, marketed by the Gardner Machine Co., Beloit, Wis., is intended to eliminate the hand labor required for operating standard grinding machines. The unit consists of a table, similar to that regularly used on a disk grinder, connected to a worm gear driving mechanism at the rear of the machine, which is driven either by an individual motor or by a belt from the drive countershaft. The gear box contains the proper reduction gears for the drive. In operation the table rocks or oscillates automatically on the rocker shaft of the grinder, causing several passes of the work across the face of the grinding disk.

The work is fed to the grinding disk by means of a spring tension which may be adjusted to suit the area of the piece being ground. An adjustment is provided in the connecting links to permit varying lengths of the travel of the table across the face of the grinding wheel. The rocking mechanism is disengaged by pressure upon the treadle, and the table is then tilted forward into the



Gardner Mechanically-Oscillating Work Table

loading position. To return it to the grinding position and again engage the rocking mechanism the operator lifts a lever provided for that purpose.

The oscillating-type tables are built for four sizes of hand-operated single-spindle disk grinders, namely, 20, 26, 30 and 40 in., and also may be applied to any of the No. 4, 6, 7, 7½, 8 or 50 Gardner grinders. It is claimed that the device will double the production from these machines.

Anderson Spotter

The Anderson Bros. Manufacturing Co., Rockford, Ill., is marketing the spotting tool illustrated for performing the operation known as frosting or flaking.

The Anderson spotter consists of a set of two spotting tools, with various sizes of guides for handling different widths of work. The set consists of one long handled spotter for heavy spotting and one short one.

Anderson Spotter

As the tool is pushed across the guide, which is placed upon the work being spotted, a rocking action is given to the blade, causing it to give the half-moon effect on the work. By adjusting a small thumb screw, a variety of different-shaped spots may be obtained. The advantages claimed for the tool are that the work can be done many times faster than by hand, and inexperienced operators can be employed.

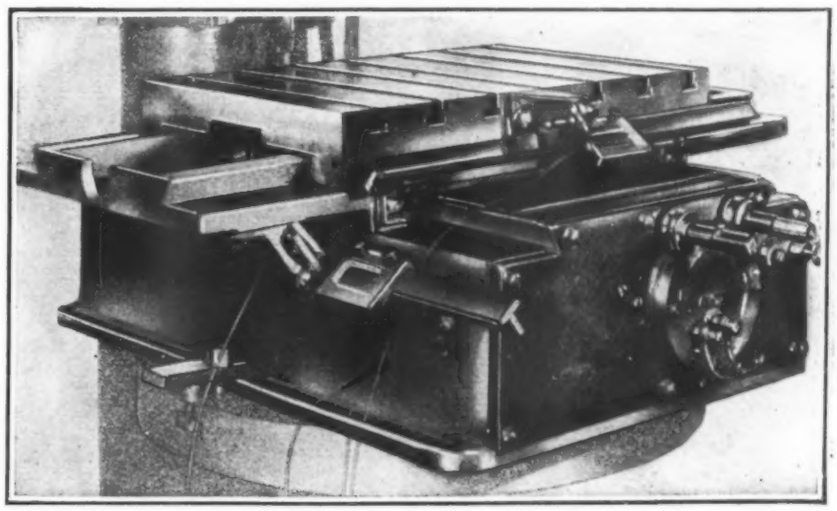
"Kellocater" Jig-Boring Unit

THE Keller Mechanical Engineering Corporation, Brooklyn, N. Y., has introduced the "Kellocater" electrically-controlled jig-boring unit. The Kellocater is said to be designed to supply the need for a mechanism, of moderate cost, capable of doing accurate locating and jig boring without the necessity of layout work with the use of scribed lines or buttons.

Any drill press with a good spindle and having a distance of 14 in. or more from the center line of the spindle to the face of the column is suitable for the operation of this device, as the unit is simply clamped to the machine table. In the Kellocater jig-boring unit the same principle is employed as is used in the Keller electrically-controlled die machines, and it is claimed that the same precision can be obtained on jig and fixture work as is done with the die machines, provided the drilling unit is accurate. Its precision is not affected by wear of the leadscrew or of any other bearing surface.

The venier scale used on the unit is employed only to divide distance. The "feel" of the operator does not enter into its reading, and, therefore, does not affect its accuracy. Mounted on the scale are sliders that carry vernier plates with means for fine adjustment after the main slider has been clamped in an approximate position. A ten-power, flat-field magnifier is carried on the slider and is adjustable over the length of the vernier plate for accurate reading.

The operating mechanism of the unit consists of an electric motor driving the longitudinal and transverse leadscrews, actuating the two table slides through a magnetic clutch. The circuit of the magnetic clutch is under control of a relay and two stop contactors. After the vernier slide has been set, the motor moves either table slide until the electric contactor on the table slide touches the end of the vernier slider, thus opening the circuit to the magnetic clutch and stopping the motion. This method of operation is used successively and independently on both longitudinal and transverse motions, thereby locating the hole accurately. The only responsibility of the operator is to set the two vernier scales correctly. The location of the work is done by power, and the machine is stopped automatically at the desired point. The stopping point is unaffected by inertia or friction in the machine parts.



"Kellocater" Jig-Boring Unit

The table of the jig boring unit is 14x20 in., with a machine travel of 12x18 in. Work considerably larger than the table can be handled, however, since the three sides are clear.

Gleason 60-Inch Spiral Bevel Gear Planing Generator

DESIGN principles of the smaller machines have now been adopted by the Gleason Works, Rochester, N. Y., for generating large spiral bevel gears with a single planing tool. The machine has a capacity for gears up to 60-in. in diam. with a 10-to-1 ratio, and up to 42 in. in diam. with a 1-to-1 ratio. The spiral angle of the gear teeth can be varied from 0 to 30 deg. Index change gears are provided for numbers of teeth from 12 to 180, not including prime numbers above 100. The machine is practically universal within its range, except for certain slight limitations between spiral angle and cone distance due to required clearances.

The tool slide is reciprocated by a simple crank drive type of adjustable stroke almost directly connected to the motor, while the gear blank rotates continuously and at a uniform rate. During one revolution of the blank, the tool makes as many strokes as there are number of teeth. These motions continue without interruption until the operation is finished and the machine is automatically stopped. Due to the continuous rotation of the blank and the tooth-to-tooth action of the tool, there is no first or last tooth, all are being worked upon continually. Uniform tooth shape and accurate tooth spacing are thereby obtained, it is claimed.

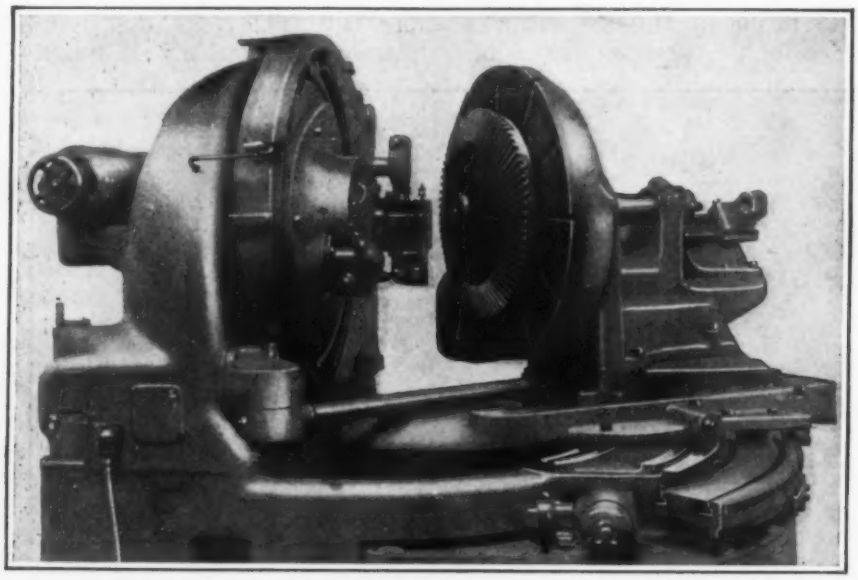


Fig. 1—Gleason 60-Inch Spiral Bevel Gear Planing Generator

For cutting bevel gears above 40 in. in diameter, machines previously built were all of the planing-forming type in which the tooth profile curve is obtained by a direct copying process. In this machine the same accurate generating principle is used as in the smaller Gleason straight bevel gear and spiral bevel gear generators, with a resulting increase in both speed and accuracy. In this generating method of cutting bevel gears, the tool is carried on a cradle which rotates very slowly, and in effect the tool represents a tooth of a crown gear. Relative motion between the blank and the tool occurs, similar to the rolling together of the gear with a crown gear. By this process a tool with straight cutting edges automatically produces the correct profile.

In addition to these motions of the tool and blanks, the cradle on which the tool slide is carried is given a slight rocking motion to obtain the desired lengthwise curvature across the gear face.

The spiral angle is controlled by offsetting the tool slide from the center of the cradle. For this purpose the tool slide is placed on a movable arm which can be swung to the required angular position about the center of the crank. If this arm is set so that the path in which the tool reciprocates passes through the center of the cradle, only a small spiral angle is produced, due to the slow rotation of the blanks. The angle can be increased as desired by swinging the tool arm away from the central position. The blanks are first roughed out with slotting and V-tools and the teeth are then finished with straight-edged tools working on one side of the tooth at a time. The same pair of finishing tools can be used for a considerable range of pitch. Due to their simple form, the cost of tools is comparatively low. The tool is lifted entirely out of the cut during the return stroke by a positively-operated clapper block.

The head on which the blank is mounted is double ended, one end being used in cutting gears and the other in cutting pinions. This design allows the use of a large index wormwheel mounted close to the gear base plate for accurately controlling the blank rotation. The head is built on a pivoted base so that the operator can easily swing either end into position. A direct-connected, constant-speed 10-hp. motor furnishes all power required for the operation of the machine. Change

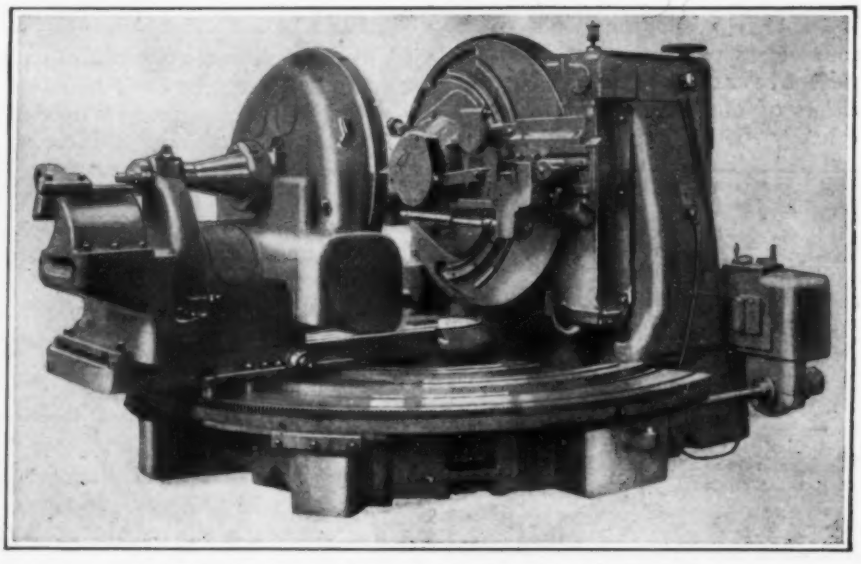


Fig. 2—Rear view of the Gleason Generator

gears are furnished for various speeds. The machine is automatically lubricated except for a few hand oilers. There is an oil pump for the lubrication system and another for the cutting oil. The lubricating oil returned from the bearings, is circulated through a filter before going back to the well, and the cutting oil is also strained.

Waterbury-Farrel Four-Post Blanking Press

THE four-post high-speed blanking press illustrated has been brought out by the Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn., and is claimed to incorporate many novel features that make for high production and ease of operation. The machine is intended for blanking from the strip, or for cutting or forming with follow tools of the progressive type.

The features claimed for the four-post blanking press are: Accurate gate guide alignment with bearings above and below the tools; shock-absorbing flywheel of assembled construction, making possible high speeds; a friction mechanism which exerts no friction except when stopping the press, and having quick application from high speed; tools and work in full view from all sides; double-gate solid connections that eliminate strain on threaded parts; lifter springs on each side post to take up blacklash in the connection bearings; double-friction adjustable roll feed, and the possibility of using any style of knockout; hand and automatic roll releases, vertical roll adjustment, and spring shock relief in the roll feed connection.

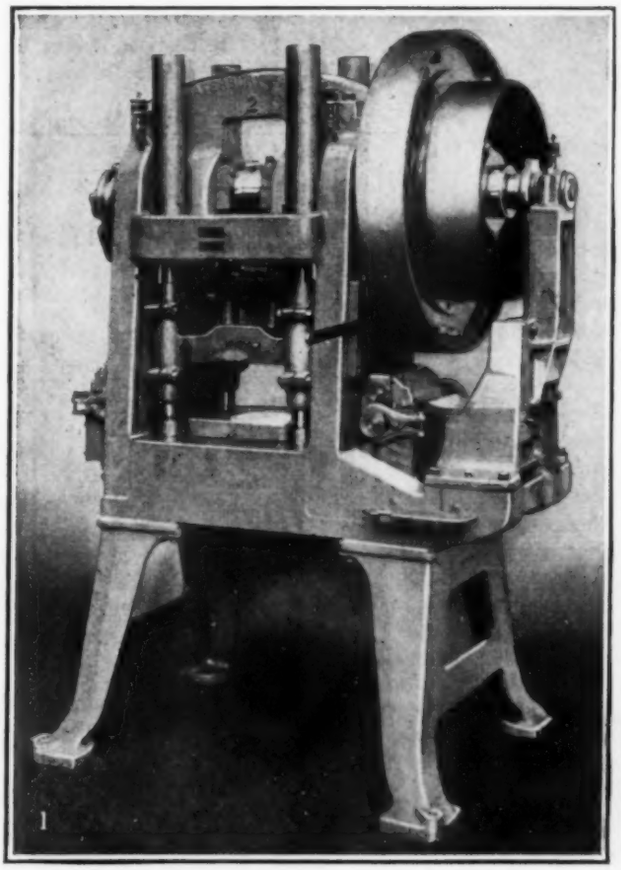
The machines are built in three standard sizes, having capacities of 20, 40 and 60 tons. The frames are designed to facilitate the application of special attachments, or to permit changing to individual geared motor drive. The speeds range from 300 to 200 r.p.m. of flywheel, and the strokes from $\frac{3}{4}$ in. to 3 in. The maximum roll feed strokes are $3\frac{7}{8}$, $4\frac{3}{8}$ and $4\frac{3}{4}$ in., respectively, feeding from left to right. The machines weigh 2,300, 5,000 and 7,600 lb., respectively.

Van Norman No. 42 Oscillating Grinding Machine

The Van Norman Machine Tool Co., Springfield, Mass., has brought out the No. 42 oscillating grinding machine primarily adapted for grinding the ball raceway in large-sized ball-bearing outer rings, within the maximum work-head swing of 16 in. The machine is also adaptable for the radius grinding of work other than ball bearings. Unit motor drive for each functioning element is incorporated in its design. The machine is rugged in construction, yet built to occupy a minimum of floor space.

The work head is supported for oscillation on a wide conical bearing, in addition to ball bearings, at both the upper and the lower ends of the vertical oscillating post. Longitudinal and cross-slides are provided for positioning the work head in correct off-set relation with the vertical oscillating-center, or axis. The motor for driving the work spindle is carried by, and is movable with, the work head.

The wheel head is of the block type and is bored to receive a quill-type wheel-spindle assembly. The motor



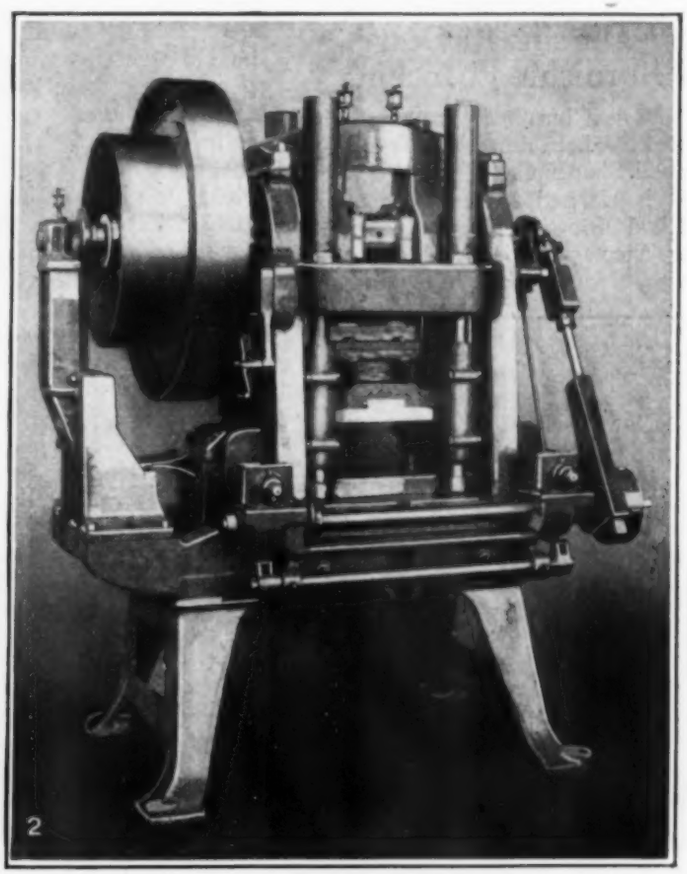
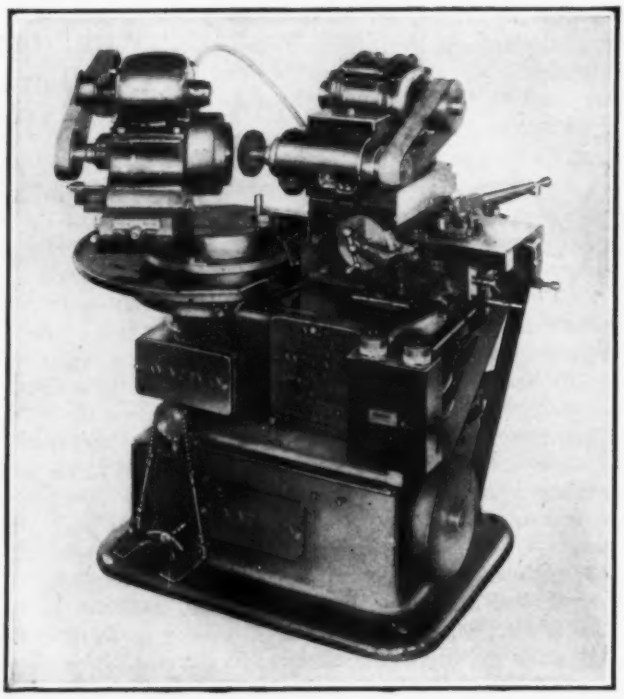


Fig. 1—Waterbury-Farrel Four-Post Blanking Press. Fig. 2—Rear view of machine

driving the wheel spindle is adjustably mounted on, and is movable with, the wheel head. The motor used for driving the automatic cross-feed of the wheel spindle and the automatic oscillation of the work head, is also mounted with adjustable features on the rear body of the machine. It is belt connected to a shaft engaging the functioning mechanism within the body of the machine through worm gearing. Adjustable clamping means are provided so that the work head can be oscillated from the required angle and length of arc, in relation to the axis of the wheel spindle.



Van Norman No. 42 Oscillating Grinding Machine

It is claimed that the machine includes sufficient rigidity and a correct balance of all functioning members to insure smoothness of operation and the elimination of vibration.

Cincinnati Gear Burnishing Machine

The gear burnishing machine illustrated has been developed by the Cincinnati Shaper Co., Cincinnati, Ohio, and is claimed to introduce a new method for finishing gears. The burnisher was designed with five points in view: First, to eliminate the personal equation in securing constant pressure; second, to provide a definite time of burnishing; third, to reverse the operations without removing the gear; fourth, to provide quick-loading and unloading facilities; and fifth, to incorporate such mechanical refinements as ball bearings and automatic oiling. The machine is entirely automatic. The operator places the gears in position between the master gears and pushes the lever down, which motion brings the gear into engagement with the driving burnishing gear. After the machine has made a pre-determined number of revolutions, the spindle is reversed, and makes the same number of revolutions in the opposite direction. It then stops automatically. The number of revolutions is controlled by adjustable dogs.

Cincinnati Gear Burnishing Machine

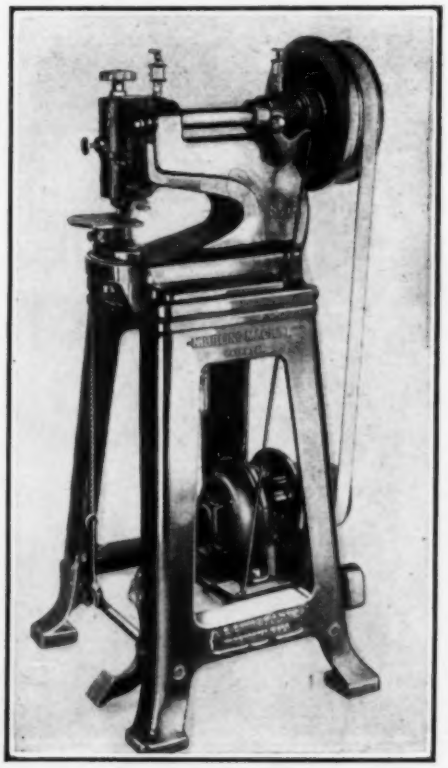
The machine requires three arbors and three master gears, one driving and two driven. The arbors and gears are only furnished on request. The pressure with which the gear engages the burnishing gear is adjusted by raising the carriage by means of a crank, which engages a shaft in the carriage trunnion. The screw is provided with a micrometer collar for fine adjustments.

The carriage can be locked in place or left free so that constant pressure is maintained by means of a counterweight on gears of slightly varying pitch diameter. The machine is designed to handle gears up to approximately 7 in. in diameter, but machines of larger capacity can be furnished to suit special cases. The machine is arranged with a flat top for the purpose of providing an overarm as an outer support to the driving arbor. A 3-hp. motor having a speed of 1,725 r.p.m. is required.

Campbell No. 1-A Nibbling Machine

Andrew C. Campbell, Inc., Bridgeport, Conn., has increased the throat of its No. 1 machine to 12 in. and has designated the enlarged size as No. 1-A. The machine is especially designed to meet the demands for a unit with a medium throat depth. It is primarily adapted for the duplication of small quantities of production parts and the making of templates, ornamental work and the like. At its rated speed of 550 strokes per minute, the machine will cut $\frac{3}{16}$ in. stock at the rate of approximately 28 linear inches per minute.

The machine requires a $\frac{1}{2}$-hp. motor to drive and it can be mounted in the lower part of the frame as seen in the illustration, or direct belt drive can be furnished at the main shaft of the machine. The machine occupies a floor space of 1 ft. 11 in. by 2 ft. 6 in. and is $4\frac{1}{2}$ ft. high. The net weight of the belted model is 490 lb. The equipment includes a circular cutting attachment, twelve double-end punches, $\frac{1}{4}$ in. in diam., three dies and the necessary wrenches.



Campbell No. 1-A Nibbling Machine

Landis Plain-Type Hydraulic Grinder

SINCE the development of its hydraulic-type grinding machine, described on page 675, Vol. 60, of the *American Machinist*, the Landis Tool Co., Waynesboro, Pa., has marketed machines suited for swings of 10, 14, 16 and 20 in., and 24 and 28 in. in any desired length with equipment to suit the grinding of miscellaneous work including roll grinding, plunge-cut grinding with continuous feed to the wheel head and reciprocating spindle, railroad work, and plain or form grinding. In addition to the features of the earlier machines that have been retained in the present model, several improvements have been made. The machine illustrated is a 10x52 in. equipped with a hydraulic power traverse to the table and a hydraulic power infeed to the wheel head.

A variable-flow oil pump and a continuous hydraulic motor furnishes the power for traversing the carriage and gives a speed range of 12 to 300 in. per min. The oil pump furnishes only the amount of oil required for any traverse speed. If a high traverse is required a larger volume of oil is pumped to the motor than is required when a slower traverse is used. It is claimed that this feature obviates any extra duty on the pump and any heating of the oil. The volume of oil pumped is readily controlled. All operating parts of the pump and motor run in oil so that on these parts little wear takes place.

The headstock is driven from a self-contained motor mounted on top of the headstock casting. The drive is through a Tex-rope to a hardened and ground worm that meshes with an alloy bronze worm gear mounted on the faceplate. The motor is a variable-speed type and is balanced. The work speed is controlled by a rheostat at the front of the machine. An automatic control panel operated through a limit switch is connected with the start-and-stop lever at the front of the machine and provides sensitive control of the work rotation.

The wheel head is constructed rigidly and is carried on flat and V bearings. The wheel feed is actuated through a screw and nut mounted on the under side of the base. The wheel spindle is mounted in large bronze cap bearings made adjustable to compensate for wear. It is lubricated automatically from a pump driven from the spindle. Provision is also made for positive lubrication of the thrust bearings. The spindle is driven from the end by a Tex-rope drive which permits a change of pulleys to be made in order to compensate for wear of the grinding wheel. An idler pulley is used to maintain a tension on the drive at all times regardless of the diameter of the pulley. Fig. 2 shows the drive with the guard cover removed, and also shows the bracket on the rear of the machine which is furnished only when the machine is arranged for lineshaft drive. When the machine is arranged for motor drive, the motor is mounted on the rear of the machine with the pulley directly in line with the pulley on the spindle.

The motors for the work drive as well as for the wheel drive vary in size depending upon the size of the machine and the character of the work. The work drive motor is of the variable-speed type having a range from 500 to 2,000 r.p.m. and the wheel drive motor, operated at 1,150 r.p.m. is of the constant-speed type.

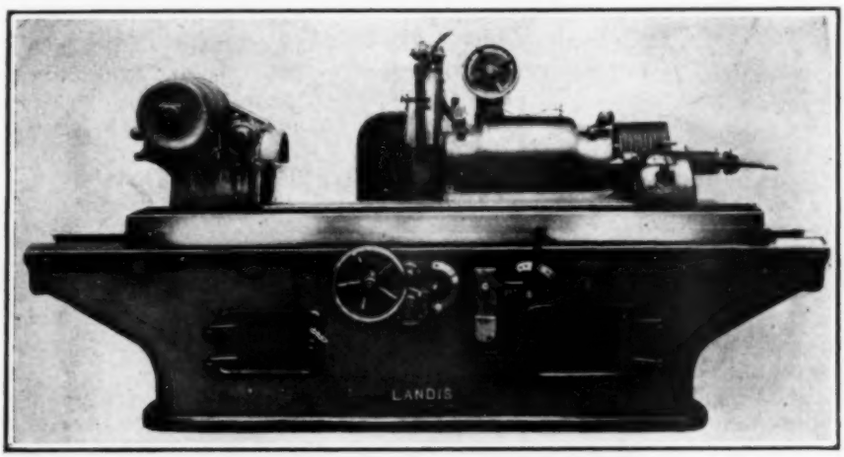


Fig. 1—Landis Plain-Type Hydraulic Grinder

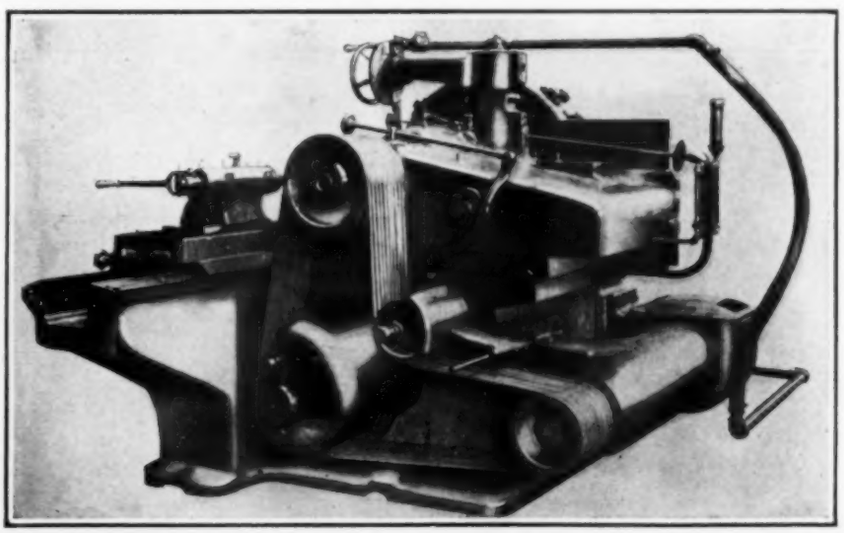
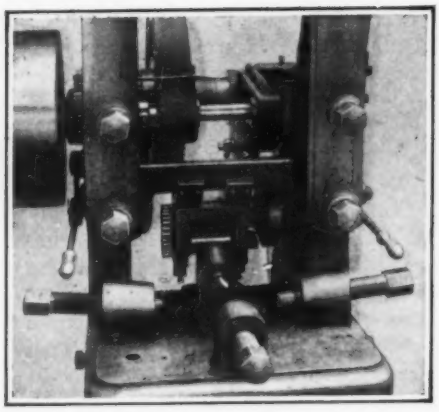


Fig. 2—Rear view of machine showing the drive

Standard Machinery Co. Automatic Drop Hammer with Roll Feed

Automatic roll feed of the conventional type, such as used on power presses, has been added to the automatic drop hammers made by the Standard Machinery Co., Auburn, R. I., as shown by the typical application in the illustration. The roll feed is inverted from its usual position in order to clear the poppet screws used for holding the dies in the machine. As on a power press, the length of stroke of this feed is controlled by an adjustable eccentric disk mounted on the driving mechanism of the machine. The feed is designed particularly for use in embossing sheets.



Roll Feed applied to Standard Machinery Automatic Drop Hammer

This type of feed is said to increase production from 40 to 45 per cent and to show a similar saving in the subsequent trimming operations, due to the fact that the embossed design is evenly spaced on a strip and, hence, can be run through a roll feed on the press for cutting out the design also. The feed acts as a safety device, as the front of the hammer is inclosed by a guard. This guard was removed when the machine was photographed, in order to show the details of the mechanism.

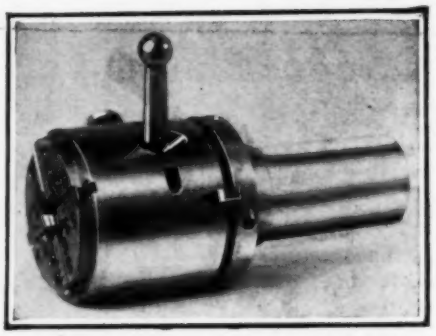
Geometric Style KH Diehead

A stationary self-opening diehead, known as the Style KH, for use in hand screw machines and turret lathes, has been brought out by the Geometric Tool Co., New Haven, Con. The diehead is opened and closed axially, permitting the simplest construction, the opening action being accelerated by two straight springs in the skeleton. The locking mechanism consists of a pawl having a broad surface of contact so that it will withstand long service.

To remove the chasers, the spring-stop plunger is pulled up when the diehead is in the open position, and then the chasers are withdrawn by hand. To adjust the diameter an adjusting ring on the back of the head is given a fraction of a turn and is then locked by a spring pin.

The chasers are backed up directly behind the cutting point by a closing sleeve and are rigidly supported on both sides and the bottom by a supplementary support, adjacent to the front plates.

The diehead is made of a special alloy steel, and all parts are hardened and ground throughout. It is built in five sizes, having a cutting range for straight threads from $\frac{1}{8}$ to $3\frac{1}{2}$ in. and for Briggs standard pipe threads from $\frac{1}{8}$ to 3 in. The same styles of chasers as used in the Style K and KD head are used so that interchangeability is possible.



Geometric Style KH Diehead

Micro Heavy-Duty Internal Grinder

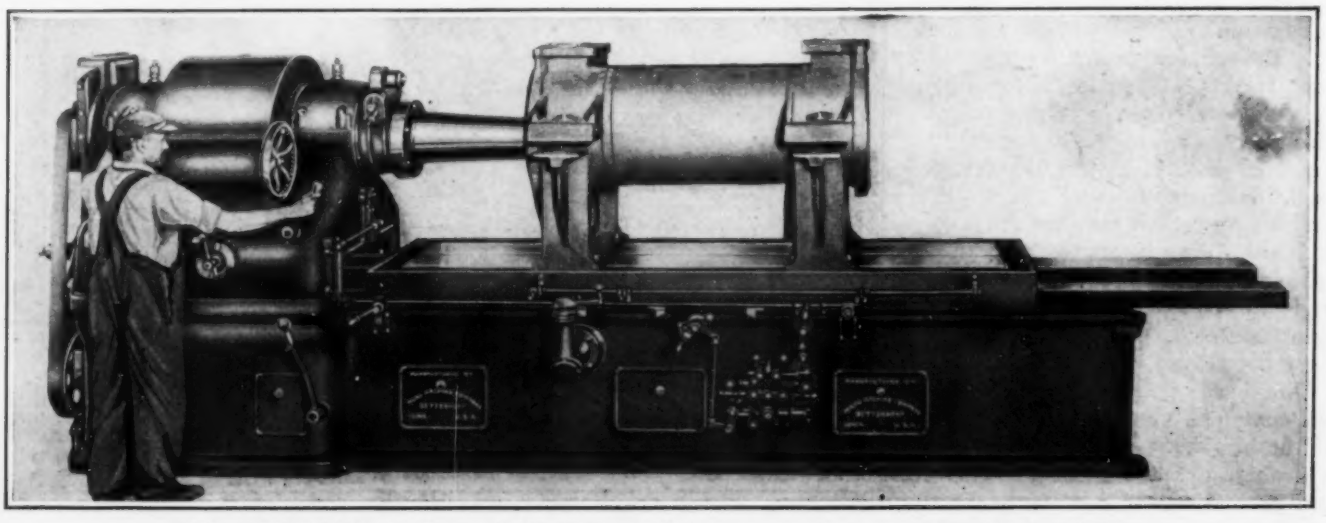
THIS heavy-duty internal grinding machine has a capacity for grinding holes from 5 to 36 in. in diam. and up to 60 in. in depth. It is made by the Micro Machine Co., Bettendorf, Ia. An indication of the size and strength of the machine is given by the fact that the length of the main bearing is 48 in. and its diameter is 14 in. The total eccentric throw of the grinding spindle is 4 in., but this dimension can be increased to 10 in. with a special double-throw eccentric.

The length of the main table is 114 in. and it is 30 in. wide. Full length and width of table are utilized for work mounting, and the usual T-slots are provided. The total table travel is 63 in. The distance from the top of the table to the center of the grinding circle is 24 in., and the height of the spindle from the floor is 60 inches.

A variable-speed drive is embodied in the machine for regulating the main cylinder speed to suit the diameter of the hole to be ground. This change of speed is instantly accomplished with a graduated dial in front of the headstock as the controlling member. A constant speed is supplied to the grinding wheel, however, through the standard Micro pantograph spindle drive which is said to eliminate backlash.

The main table is driven hydraulically. This drive incorporates a pilot valve controlled by one operating lever so that a wide range of table feeds are available, including rapid traverse.

The automatic eccentric feed mechanism is so designed that the operator may set sliding dogs on the side of the table to increase the depth of grinding cut at each end of the table stroke automatically, so as to insure



Micro Model H. G. Heavy-Duty Internal Grinder operating on a steamboat cylinder

maximum production. A graduated dial is embodied in the eccentric feed mechanism to permit duplicate sizing of holes.

The main cylinder and main table are lubricated with a force-feed oiling system. The oil is filtered before returning to the bearing surfaces. All slide ways are protected from dust, and all revolving shafts are mounted on special selected ball bearings.

A 15-hp. motor rotating at 1,750 r.p.m. is required for driving. It is mounted behind the machine or in a pit. The floor space required is 6x22 ft. while the approximate weight of the machine is 25,000 lb. net.

Gridley 1⅜-Inch 4-Spindle Automatic

AT THE Windsor, Vt., plant of the National Acme Co., Cleveland, Ohio, there was recently developed the 1⅜-in., 4-spindle Gridley automatic shown in Figs. 1 and 2. This machine was designed around the basic Gridley idea of carrying the longitudinal turret upon a continuation of the spindle carrier. Beyond this general principle of design, however, many radical changes have been made over previous models.

A particular feature of the machine is the spindle construction illustrated in Fig. 3. The spindles are all equipped with special SKF precision ball bearings. Four single-row bearings, opposed in pairs with initial thrust, carry the combined radial and thrust load at the front of each spindle, while two similarly opposed single-row bearings at the rear are mounted with axial float to allow for expansion and contraction of the spindles.

The length of the spindle carrier between its bearings has been increased 50 per cent, thereby adding to the rigidity of the mounting. A third disk has also been added between the two outside bearing carrier disks to take care of the Geneva stop mechanism, which has also been redesigned to cut the idle time and to reduce shock. The tail of the spindle carrier, shown in Fig. 3, has a hardened and ground steel sleeve as a turret bearing. Changes have also been made in the stock feeding mechanism to bring about more positive action. The cams act directly on the pusher tubes and the chuck-operating spools. As a result of the added supports, slides and other details incidental to this mechanism, the entire appearance of the rear of the machine has been changed.

The cross-slides, both front and rear, have been increased in area, and there is more power available for them. Shelves are cast integral with the headstock and frame, and these give full-length support to the heavy slides which are held down to them by heavy outside gibs. Power is delivered to the cross-slide by direct cam action through a steel drawbar of large diameter carried in outboard bearings in the bed of the machine. The forming slides have been increased in size to permit the use of the widest forming tools in any or all of the four positions. The slides have been made heavy enough to allow these tools to be pushed to the full limit without chatter, deflection or stalling of the machine, it is claimed. For the same reason, the cutting-off operation can be accomplished with speed and smoothness.

The so-called feed-bracket mechanism, which controls the spindle speed, rate of feed, indexing, operation of auxiliary mechanism, etc., has been entirely redesigned. It is fully inclosed and is fitted with splashers by which the entire mechanism is caused to run in an oil mist. The shafts in this mechanism, as well as all other high-speed shafts in the entire machine, are mounted upon ball bearings. This feed bracket permits threading in the two upper positions without special attachments, as the threading mechanism is built into the machine. A disk clutch is used in the revolving mechanism.

The change gears for both speed and feed are of the removable type, and can be quickly changed by removing slip washers. They are reached through hand holes provided with covers that can be sealed against tampering.

An interlocking arrangement is

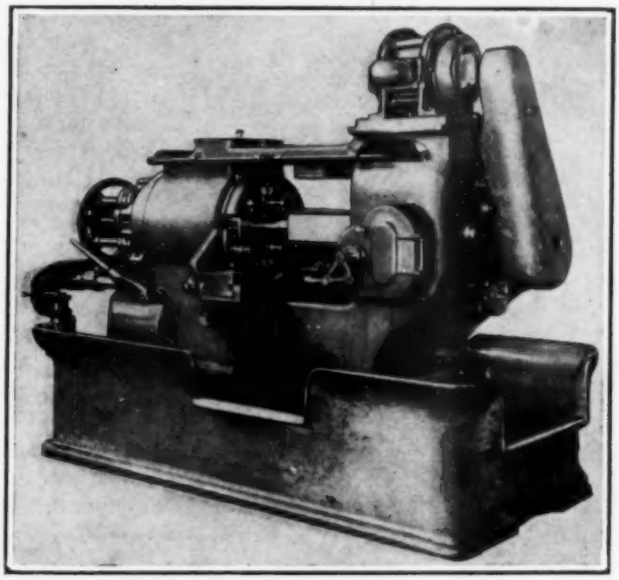


Fig. 1—Gridley 1⅜-Inch, 4-Spindle Automatic

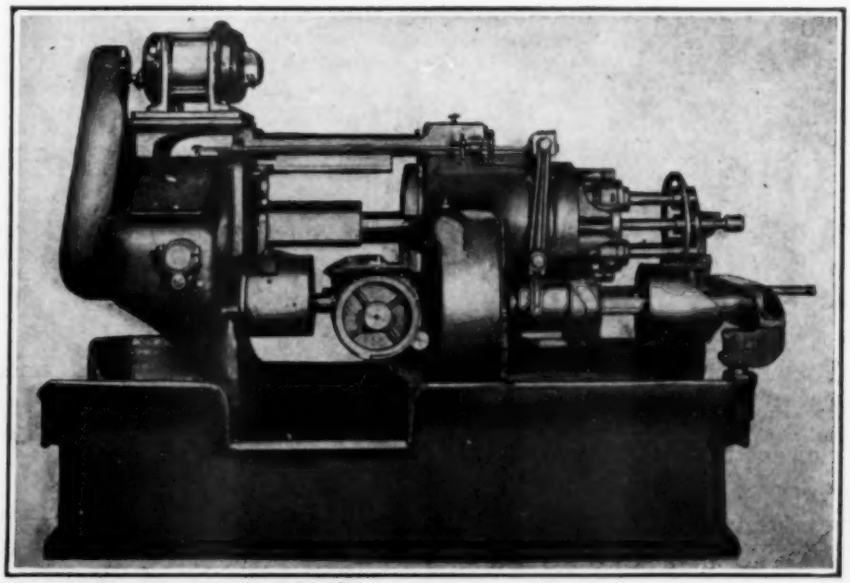


Fig. 2—Rear view of the machine

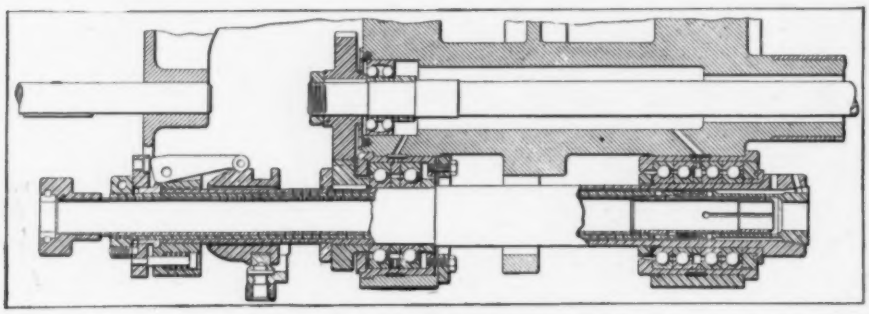


Fig. 3—Ball bearing spindle construction

made between the power revolving mechanism and the hand revolving mechanism, so that it is impossible to use the hand crank when the power comes into play. The stock stop, located in the fourth position, is hung upon a heavy pivot and is cam-actuated so as to clear the tools as soon as a new length of stock has been gaged. This construction permits the fourth position to be used as a full tool position.

The pan on the machine is different in appearance and in internal arrangement. Its high sides serve as guards, as well as giving increased chip capacity. In these sides there are four large ports with external lips and internal sloping surfaces, which permit the clearing out of the accumulated chips at either end or either side of the machine. It is possible to apply a continuous chip removing mechanism on the conveyor belt principle. Such an arrangement is now under development by this company. The chief feature of the pan, however, is the arrangement whereby the bulk of the oil is immediately separated from the hot chips through the medium of perforated plates of large area that make up the bottom of the chip compartment. This, together with the fact that there is a large amount of heat-radiating surface in the pan, keeps the oil relatively cool. It thus has a marked effect in holding down the temperature of the machine and the work.

As a result of these major improvements, plus many minor ones, several claims are made: 50 per cent increase in spindle speed; a corresponding increase in tool feed; material decrease in the so-called idle time, that is, the time for indexing, stock feeding, and returning the tools. Besides increase in production, increased reliability is also claimed.

Hanchett Locomotive Guide-Bar Grinder

IN THIS Hanchett locomotive guide-bar grinder the work is supported upon a stationary table while the grinding wheel head is reciprocated. The machine is made by the Machinery Company of America, Big Rapids, Mich. Increased accuracy and production is claimed for this principle of design.

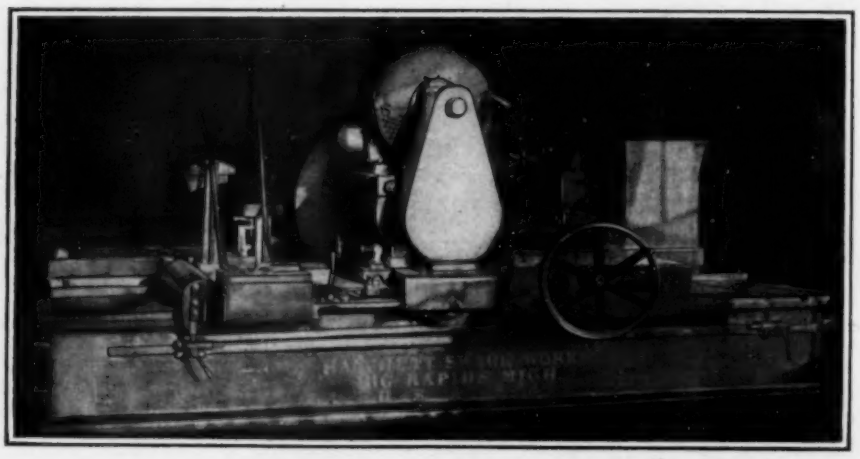
The rotating or swiveling guide-bar holder is so arranged that one setting of work can be installed while another setting is being ground. After one guide bar has been ground, the guide bar holder is swiveled on ball bearings, thus bringing the next set-up into proper grinding position, where it is clamped. Thus, the grinding operation is practically continuous. The holder is so designed that the second set-up can be readily arranged and adjusted to any desired position or angle by the aid of gages. The particular machine shown will handle work up to 84 in. in length and 20 in. in height.

The bed has a three-point bearing on the floor, and has a length of 139 in. and a width of 30½ in. The platen table measures 100x24 in., and has drainage pockets at each end. It is provided with T-slots for ¾-in. bolts.

A grinding wheel 30 in. in diam. by 4 in. face is regularly furnished. The spindle is mounted upon two SKF radial bearings and one large thrust bearing. The spindle is driven by a 25-hp. motor through a Link-Belt silent chain and gearing running in oil. The wheel speed is about 500 r.p.m., while the carriage is traversed by rack and bull gear at rates of 12, 17 and 24 ft. per min. At its extreme travel the carriage has an overhang of 10 to 15 in. Hand cross-feed of the carriage is controlled in front, but automatic feed changes can be made either from the front or back, as can power quick return of the wheel to and from the work at start or reverse of the carriage. Automatic feeds, ranging from 0.0005 to 0.005 in., operate at both ends of the carriage travel.

Automatic lubrication is provided both to the bearings and the ways, through a constant flow of oil on the ways from the moving carriage. Coolant is supplied from a submerged motor-driven centrifugal pump with a capacity up to 30 gal. per min. A 50-gal. supply tank is cast in the base, with a 15-gal. overflow or settling tank.

The machine occupies a floor space of 7x13½ ft. and its net weight is about 17,000 pounds.

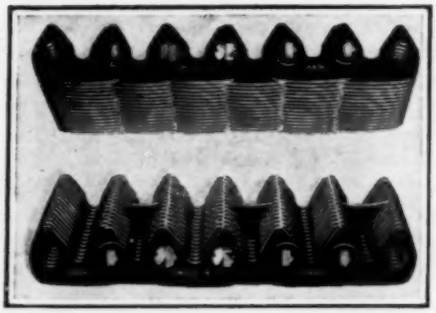


Hanchett Locomotive Guide-Bar Grinder

Morse Improved No. 55 Chain

An improved rocker-joint chain is announced by the Morse Chain Co., Ithaca, N. Y. In the improved design, known as Type 55, the links are the same length and height as the old ones so that the chain will run on all standard sprockets.

The joints shown in the illustration operates on the same principle as the original Morse rocker joint. The seat pin, at the left, has been enlarged to give greater bearing surface and also



Morse Improved No. 55 Chain

to make a stronger transverse member to hold the chain together. The rocker pin at the right has been changed in contour, thereby giving a better surface of contact with the links. The combined joint members give a more nearly round hole with reduced clearance, thus holding the link more accurately on the pins. This construction is said to result in a smoother running chain. The chain is more rugged, and the breaking strength has been increased about 50 per cent.

Cleveland Improved Open-Side Planer

Improvements to the Cleveland open-side planer made by the Cleveland Planer Co., Cleveland, Ohio, include the substitution of a single motor on the column for the rapid traverse to the heads and for elevating and lowering of the rail in place of two motors previously used. A gear box has been substituted for the second motor. Two additional bearings have also been placed in the gear train. One is an outboard bearing supporting the first driving bevel gear previously overhung, while the other outboard support bearing is on the second reduction shaft. The bevel gears are now hardened.

Carborundum Aloxite "AA" Grinding Wheel

A line of Aloxite "AA" grinding wheels for tool room work is being marketed by the Carborundum Co., Niagara Falls, N. Y. The Aloxite wheels are made of an aluminous abrasive, and are claimed to have the proper sharpness and just the degree of toughness or temper, combined with proper bonding, to make them fast and free cutting on toolroom precision work. The wheels are suitable for both light and heavy cuts, and are claimed to work without creating undue heat. The wheels are standardized in various grades and grit.

Pond Improved "Time Saver" Lathes

GREATER range of spindle speeds, larger driving gears, Timkin roller bearings in the head, solid spline shafts for the sliding gears, and a new taper attachment, are some of the features of the improved line of Pond "Time Saver" lathes made by the Niles Tool Works Co., Division of the Niles-Bement-Pond Co., Hamilton, Ohio. The lathe is built in three sizes, of 27-, 30-, and 36-in. swing, and with any desired bed length. The drive may be by a variable-speed d.c. motor, a constant-speed a.c. motor, or a single pulley. In the two latter cases, all speed changes are made mechanically, twelve speeds being provided. The general construction of the headstock for all drives is similar, except for the additional gears and the mechanical brake in the last two models.

In the illustrations, a front and rear view of the 27-in. size are shown. It is driven by a 20-hp., variable-speed d.c. motor and has a 1-hp. motor to operate the carriage, rapid power traverse and the coolant pump. There are four mechanical spindle speed changes, which, in conjunction with the electrical control, provide faceplate speeds ranging from 4 to 220 rev. per minute.

Four of the shafts in the train are mounted on Timken tapered roller bearings in the upper half of the housing, while in the lower half the main spindle and splined sliding gear shaft run on large bronze bearings. Altogether, there are twelve gears in the head. Due to the small number of gears in the drive and the large space provided, gears of large proportions have been utilized. The motor pinion, which is mounted between two bearings, and its mating gears have helical teeth, while the other gears are straight spur. All gearing is of heat-treated alloy steel and is totally inclosed in an oil-tight housing. Oil is pumped continuously to the top of the gear box, where it is piped to individual bearings and gears.

In the improved machine, the position of the drive motor has been reversed; the pinion is placed nearest the faceplate. This construction permits the use of motors of various frame sizes without obstruction to the operating space above the faceplate. A patented feature of the lathe is a job push-button switch, which enables the operator to shift gears or to inch the faceplate by small increments when setting up or testing work.

The carriage is equipped with a power rapid traverse as a regular feature. The motor is at the rear of the machine, and is connected through reduction gearing to a screw running the full length of the bed. This screw has a coarse-pitch, right- and left-hand thread that engages corresponding nuts carried at the rear of the carriage and connected to a lever at the front. This same lever also controls the longitudinal and cross feed, according to which plane the lever is moved in. The mechanism is so constructed as to prevent the engagement of feed and power traverse at the same time, and is otherwise completely interlocked. The cross-slide bearing of the carriage has been increased in width, and the tool slide has been offset so that threads can be cut conveniently.

The apron is a one-piece box form

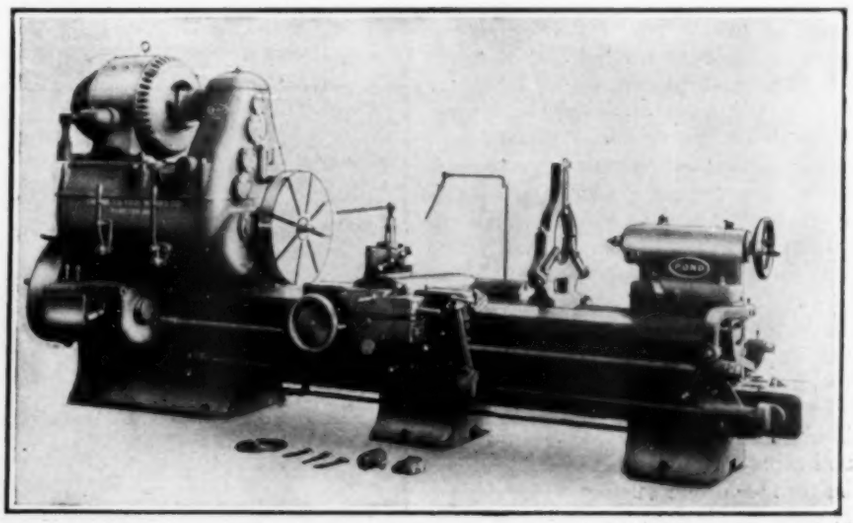


Fig. 1—Pond Improved 27-Inch "Time Saver" Lathe

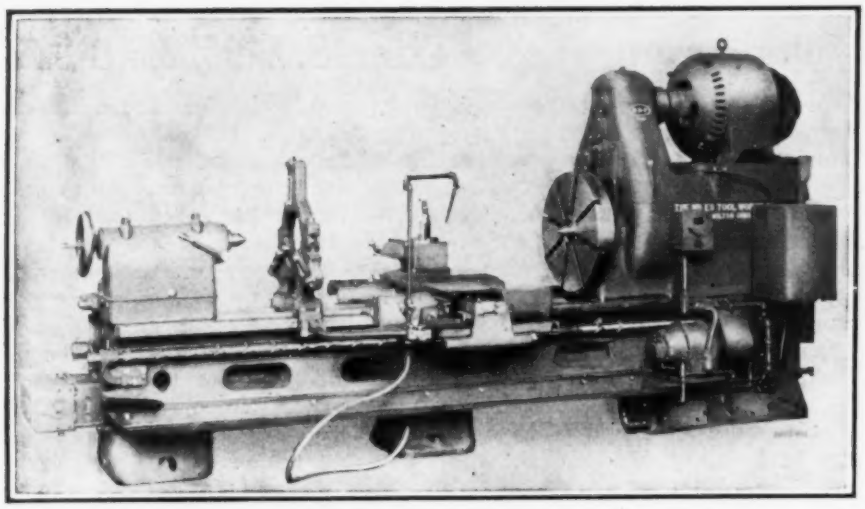


Fig. 2—Rear view of the lathe

casting, in which all gears are fully inclosed and supported on both sides. All gears and clutches in the apron are of heat-treated steel. Two oil reservoirs lubricate all gears, bearings, and leadscrew nuts. The engagement of the feeds is through two positive fine-tooth clutches, so that the feed can be snapped in and out instantly without slippage. A large thread dial is incorporated in the carriage.

The quick-change gear box makes available thirty-two feeds and threads, and sixteen additional feeds and threads may be obtained by varying the ratio of the gears at the end of the lathe. A direct-reading index plate on the cover of the box permits the selection of the feed or thread desired quickly.

The bed is a 25 per cent steel casting and retains the compensating V-ways as before. It has double cross-ties spaced every two feet with sloping solid web tying the front and back walls together. This web serves to deliver the chips to the rear of the machine, away from the operator's feet. Double-track wipers, consisting of thin brass plates, pressed lightly against the ways push off the larger chips, while heavy felts take up any small particles that may have passed under the strips. Lubrication of the ways of the bed is through covered oil cups directly to the carriage ways between the wipers.

The taper attachment has been made considerably more rigid than in the previous design. It travels with the bed and is always ready for use. The attachment will turn tapers up to 3 in. per ft. either side of parallel, and tapers up to 18 in. in length may be turned in one setting. The design is such that it does not interfere with the tool setting.

Gairing Inserted-Blade Cutters

Multiple blade reamers and boring tools are being made by the Gairing Tool Co., Detroit, Mich. In Fig. 1 a reamer is shown and in Fig. 2 a multiple boring tool. Both tools can be adapted to the Gairing standard drive shank.

The blades are held in the body by friction. A double angle causes the high-speed steel blade to tighten itself in place and have a bearing on all sides. This is said to make a rigid tool and when the blades are driven in place makes practically a solid unit. A greater range of adjustment is also claimed. This is accomplished by placing a shim in the slot at the bottom of the blade. The outside diameter of the tool is ground after shimming. The advantage over a solid tool is longer life and lower cost per tool. When the outside diameter of the blades wear down the shim brings the blade up on the diameter and out on the length.

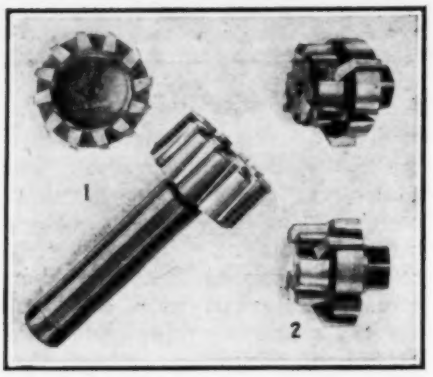


Fig. 1—Gairing Inserted-Blade Reamer. Fig. 2—Inserted-Blade Multiple Boring Tool

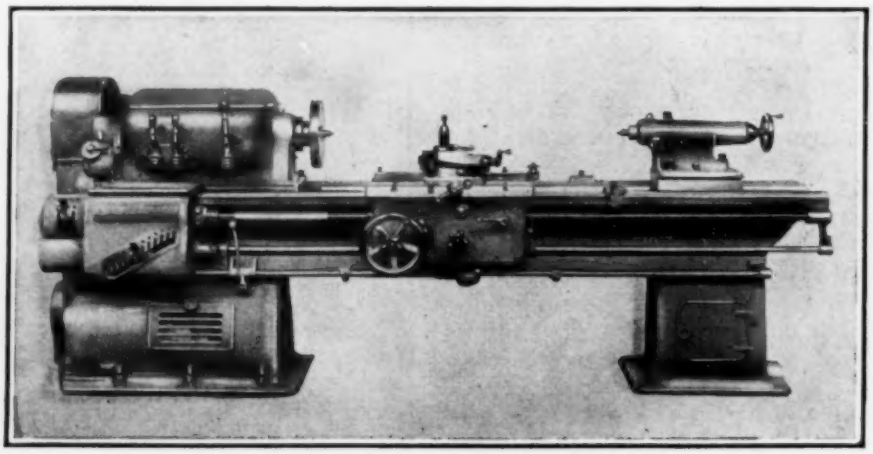
The bodies that hold the blade are made from vanadium steel. The tools are made in any size from 1¼ in. in diam. up.

Hendey 12-Speed, Geared-Head Lathe

THE Hendey Machine Co., Torrington, Conn., has placed on the market a geared-head lathe to swing 20 in. over the shears. It is supplied with beds 6, 7, 8, 10, 12, 14, 16, 18 and 20 ft. long. It is driven by belt to a constant-speed pulley from a motor in the cabinet leg, or can be driven from an overhead countershaft.

Two levers are provided to operate the friction clutch and brake by which the lathe is started and stopped; one lever on the bed to the right of the gear box and the other bracketed to and moving with the carriage.

Twelve spindle speeds are available, ranging from 7.8 r.p.m. with countershaft drive and 9.5 with motor drive to 373 r.p.m. and controlled by the levers on the front of the headstock. All gears are cut from steel



Hendey 20-Inch, 12-Speed, Geared-Head Lathe

and are heat-treated. All gear shafts run on ball bearings. The headstock contains an oil reservoir from which the gears and bearings are lubricated by splash. The last gear of the train runs free on the spindle and is engaged thereto by a sliding clutch and keys.

The spindle nose is $3\frac{1}{8}$ in. in diam. and has four threads per in. The hole through spindle is $1\frac{5}{8}$ in. in diam. with a bushing to take a live center. The front taper bearing of the live spindle is 3 in. to $3\frac{3}{4}$ in. diam. by $5\frac{5}{8}$ in. long, while the rear taper bearing is $2\frac{7}{8}$ in. to $3\frac{3}{8}$ in. diam. by 4 in. long.

Thirty-six feeds, ranging from 12 to 672 rotations of spindle per inch, and the same number of threads, from 1 to 56 per inch, are available. Provision is made for change gears in the driving train to cut threads not listed on the index. An automatic stop is provided to disengage the feeding or threading movements in either direction at any point for which it may be set.

The apron is of double-wall construction, providing outboard supports to all studs and a bearing on each side of the rack pinion. A safety interlock prevents engagement of longitudinal feeds and the threading nut simultaneously. A reservoir in the apron contains oil to lubricate the gears and bearings.

The carriage has a bearing of 27 in. on the shears. The swing over the carriage is 12 in. The cross-feed screw has a micrometer-graduated dial reading to 0.001 in. of diameter. The compound rest has a travel of 5 in. and may be adjusted to any angle. The tool post has a capacity for shanks of $\frac{5}{8}$ in. by $1\frac{1}{4}$ in. section.

Regular equipment includes plain and compound rests, necessary wrenches, large and small faceplates, center-rest, follow-rest, micrometer carriage stop and power cross-feed. An oil pan for any length of bed is furnished as an extra.

The weight of the lathe with 8-ft. bed and motor cabinet, crated and skidded for shipment, is approximately 6,000 lb. The lathe is furnished, if desired, with a two-speed countershaft instead of motor.

The same lathe may be furnished with carriage turret and forming attachment instead of the tailstock, if so desired.

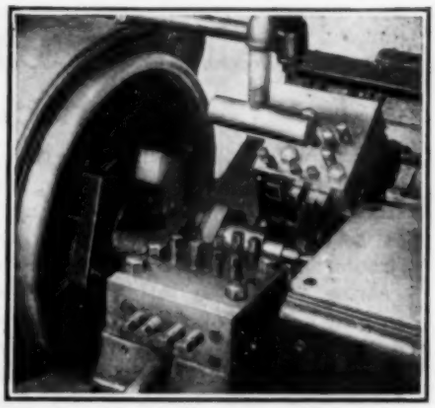


Fig. 2—Clamping mechanism in the center driving head and tooling arrangement

LeBlond Center-Drive, Automatic Crankshaft Lathe

PRIMARILY, the center-drive, automatic crankshaft lathe, illustrated in Fig. 1, made by the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio, is intended for forming the stub and flange end bearings of crankshafts simultaneously. It can also be used, however, for forming the ends of rear axles and other work required to be formed on both ends.

The crankshaft is held in a central driving head by the previously machined center bearing and, in addition, is supported by adjustable centers. The center drive member can be supplied with two-bearing or single-bearing crankshaft support, according to requirements. The drive from the headstock to the center head is by an overhead shaft, to which power is communicated from a large helical gear on the headstock spindle. The revolving member of the center head runs in two bronze ring-bearings. These bearings are readily replaceable, and ample provision has been made for their lubrication.

The forming tools are carried in four toolblocks, two at the front and two at the rear, each pair being at opposite ends of the crankshaft. The members of each pair, consisting of one front and one rear toolblock, are fed toward the center by means of hardened profile plates attached to the facing slide carriages. These profile plates are engaged by hardened rollers which transmit the movement through rack and pinion to the facing tools. The profile plates are made so that after the tools are fed down to depth, the slides continue to travel for a short distance with the rollers riding on a flat portion of the profile plate, so that accurate sizing takes place. The rapid power traverse is automatically controlled, and an automatic stop to the spindle is provided.

Power to the headstock is transmitted through a single pulley containing a multiple-disk friction clutch and brake. The spindle is driven by means of a large diameter helical gear. The spindle bearings are of bronze, lined with babbitt metal, and are replaceable.

The tailstock is of the shaper-ram type and is operated by a rack and pinion.

The loading device consists of a cradle, an overhead rail and air hoist. After the crankshaft has been handled in and out of the machine, the cradle is rolled back out of the way. The air hoist is controlled by a valve on the front of the machine.

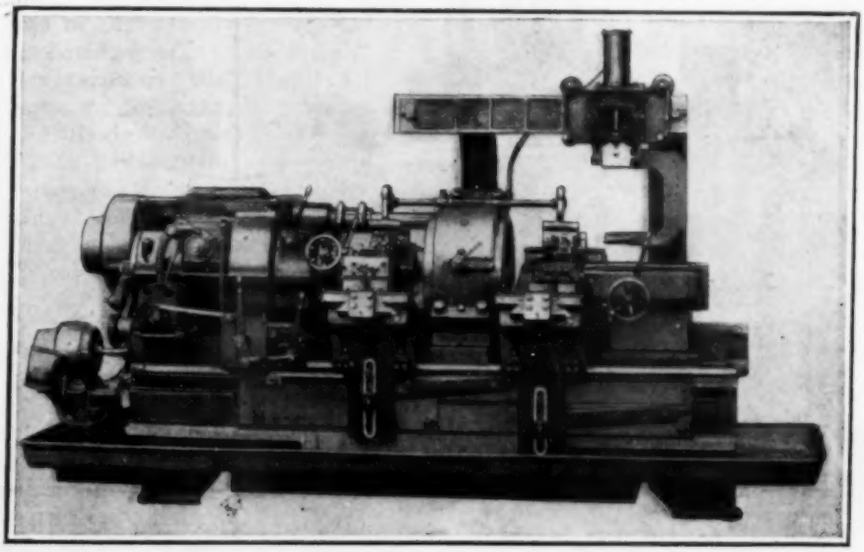


Fig. 1—LeBlond Center-Drive, Automatic Crankshaft Lathe

Gallmeyer & Livingston No. 4 Surface Grinder

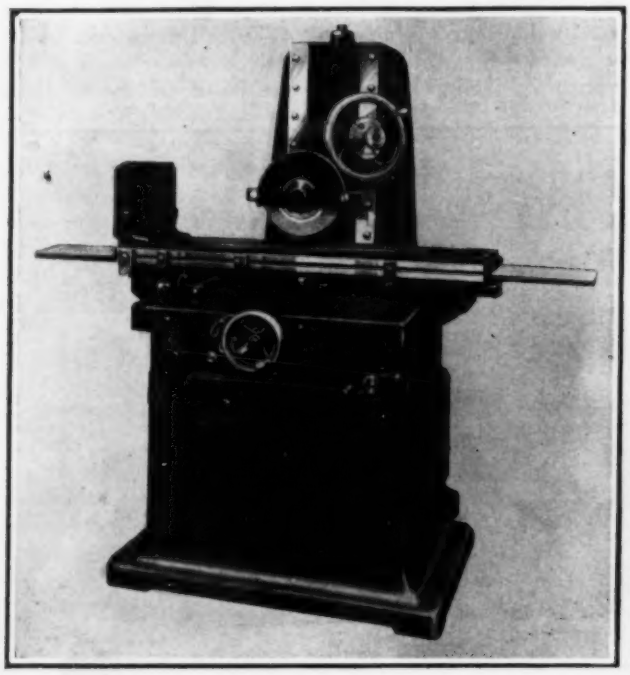
IN THE No. 4 surface grinder made by Gallmeyer & Livingston Co., Grand Rapids, Mich., the table is reciprocated by an Oilgear hydraulic feed. The elimination of gearing is said to result in an improved surface of the product as no gear tooth marks will show. Besides this advantage, a complete range of feeds from zero to 55 ft. per min. is available by simply turning a handle on the front of the base.

The same Oilgear drive is connected to a cross-feed engine mounted under the saddle which is so arranged that at each reversal of the reciprocating table, it actuates the cross-feed mechanism. This device may be set to operate at each end of the reciprocating table stroke or at one end only and can be set to feed the table either in or out. The amount of cross-feed for each reciprocation of the table is also adjustable.

The base is a single casting weighing over 1,600 lb. and it has a three-point bearing on the floor to insure freedom from strain. The base measures 42x40 inches.

The spindle head is a heavy casting accurately fitted to the vertical ways. It carries an extra-heavy spindle, 2 in. in diam. by 8 in. long in the main bearing, with an auxiliary rear bearing 1¾ in. in diameter by 5 in. in length. The spindle is heat-treated and ground and is made of high-grade material. The bearings are bronze with convenient means for take-up. Both the front wheel bearings and the elevating screw are located directly in the center of the vertical ways to avoid any tendency to cock while the head is being elevated. The elevating screw is 1½ in. in diam. and operates in a long bronze nut on top of the main frame.

Another feature of the machine is the method used to raise and lower the wheel head. For rapid adjustment over considerable distances, a large handwheel is used. This gives direct action through a worm and worm gear, to the elevating screw. This handwheel is graduated on its periphery in quarter thousandths with a movable pointer which can be set for convenient readings. When, however, it is desired to get accurate readings for grinding to close limits, the fine adjustment can be used. A smaller knurled handwheel in the center of the large handwheel provides a back-geared action to the elevating mechanism. The disk in the center of the handwheel has a graduated dial ring which can be easily set at zero in relation to the pointer mounted on the spoke of the large handwheel. Both inner and outer wheels turn but the graduations on the inner wheel are arranged to read on this moving pointer, providing a vernier effect. By this means adjustment can be made in tenths of a thousandth of an inch, with the ten thousandth graduations over ⅛ in. apart.

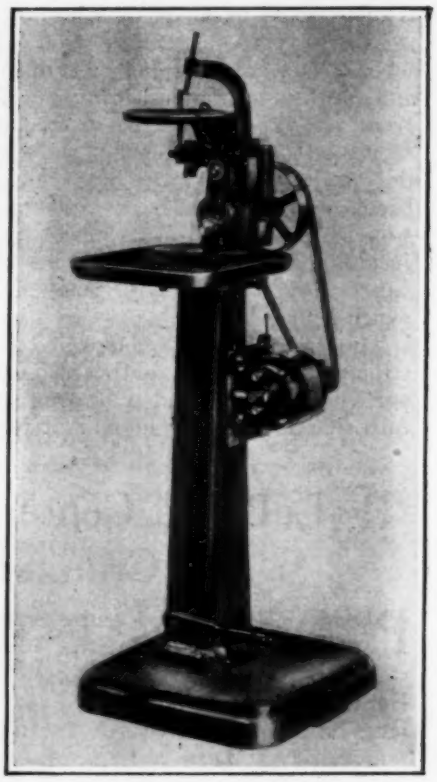


Gallmeyer & Livingston No. 4 Surface Grinder

The standard spindle construction is arranged for mounting wheels 10 in. in diam. by ¾ or 1 in. face. Variations from the standard can be taken care of on special order. The illustration shows the machine with self-contained motor drive in the base and equipped for dry grinding only. The machine is also offered with a wet grinding arrangement, including pump, tank, convenient splash guards and piping, or it can be had with a dust collecting system for dry grinding, if so desired. A specially designed magnetic chuck is also available.

Cochrane-Bly Portable Filing Machine

The Cochrane-Bly Co., Rochester, N. Y., is placing on the market the No. 1 portable or bench filing machine illustrated. The machine is mounted on a pedestal having casters and an elevating track so that the column can be raised off of the floor. The machine can thus be moved easily to any suitable position for connection to a light socket or to suit other requirements.



Cochrane-Bly Portable Filing Machine

Blount Motor-Driven Grinders and Buffers

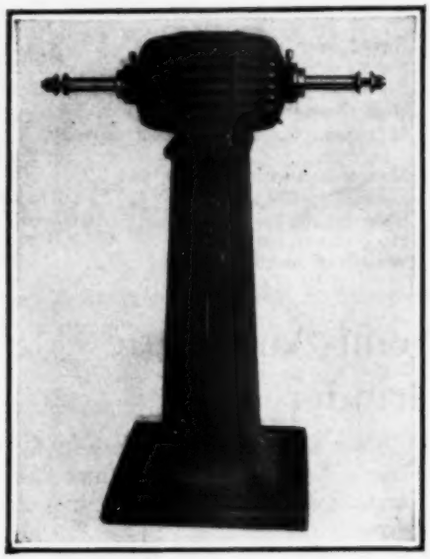
An improved line of motor grinders and buffers is being produced by the J. G. Blount Co., Everett, Mass. The motor used in these units has been especially designed for this class of service and by bettering its power factor, lower current consumption is obtained for the same output power. At the same time heating of the motor has been reduced.

Mechanically, the design of the

motor has been improved also. Much larger spindles are used to give increased load capacity and ability to withstand severe and continuous service. For the same reason the spindle ball bearings have been also increased in size. They are of the heavy-duty deep-groove type carrying both radial and thrust loads.

The motor frame and endshield are of the corrugated type of extra strength and area to help dissipate the heat. Added precaution against the entrance of dust and dirt in the bearings has been taken by means of felt packings, at both the front and rear of the bearings. The possibility of the entrance of oil in the motor has also been guarded against by means of the endshields cast with a guard on the inside.

The improved line comprises motor grinders, buffers and combination grinders and buffers, both floor and bench types from ½- to 7½-hp. capacity, for use with alternating current only. The machines are fully assembled and wired ready for use. On the smaller sizes snap switches are used, while on the larger ones automatic starters with overload and low-voltage protection are regularly furnished.



Blount Motor-Driven Grinder with Floor Stand

Acme Heavy Universal Turret Lathe with Duo Control

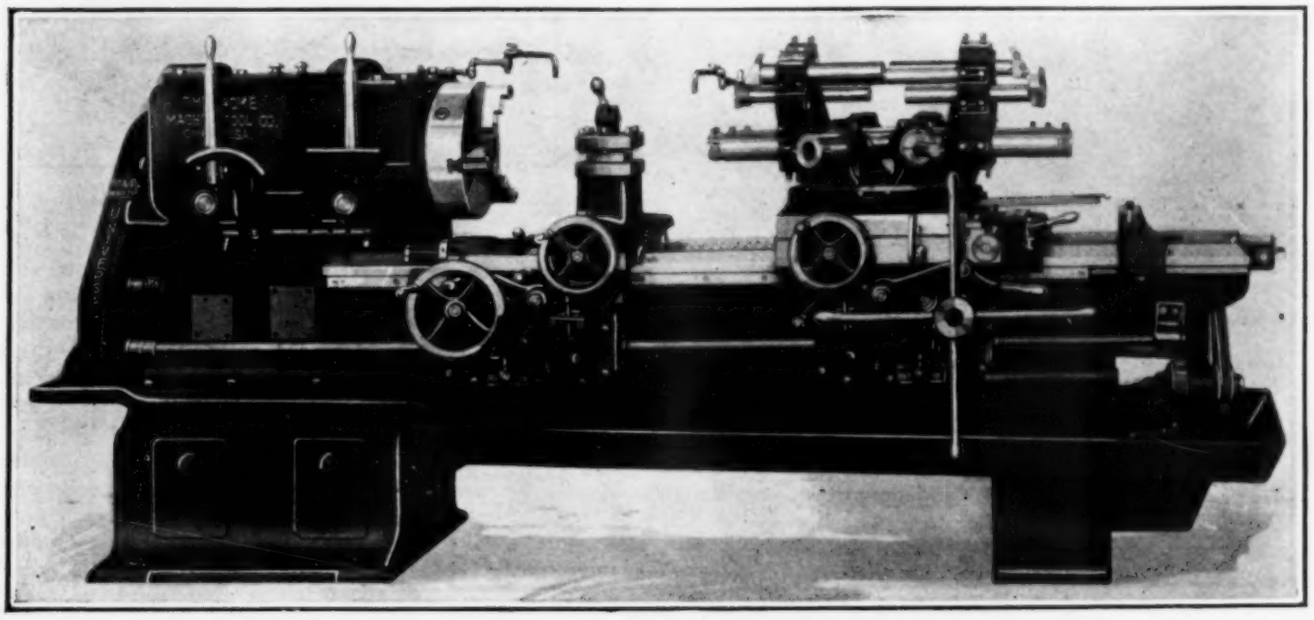
A HEAVY type full universal turret lathe of 4½-in. bar capacity has been placed on the market by the Acme Machine Tool Co., Cincinnati, Ohio. Many radical changes have been made in this machine over those previously marketed. Ball and roller bearings are featured together with simplified control.

The all-geared head, driven by a single pulley is operated through alloy-steel, heat-treated gears. All speed changes and changes of direction are made by two levers conveniently positioned in front of the headstock. A multiple-disk clutch on the initial driving shaft automatically disengages when the changing levers are shifted. All the transmission shafts revolve upon Timken roller bearings. The bearing housings are bored integral with the bowl, which is brought up to full height. This construction gives extra strength on the head and full side seating on the bearing caps of the main spindle, besides preventing oil leakage. Lubrication is supplied to all the bearings by the splash system.

The spindle driving gear is close to the front bearing, and there are no rotating gears on the spindle to cause extra bearing load. The thrust on the spindle is taken by a ball bearing of large diameter seated against the bowl. The pilot housing or guide bar is fastened directly to a planed seat on top of the bowl instead of being on the cover, so that rigidity of support is assured. As in previous machines the head is cast integral with the bed.

The motor is placed in the head-end leg, which is of the cabinet type and is connected to the driving pulley by a 5-in. belt or chain. The bed plate for the motor is removable and can be slid out for drilling after the positions of the holes for the holding bolts have been marked.

Each apron contains a separate feed transmission consisting of heat-treated gears of the sliding type and providing twelve changes. Square shafts running in ball bearings are used for the sliding gears, and the whole mechanism is revolved in an oil bath. There are two points of control on the apron itself so that the operator does not move from the operating position to make changes in speeds or feeds. The side carriage spans the ways of the bed and eliminates all overhang of square turret



Acme Heavy Universal Turret Lathe with Duo Control

tools and is so constructed that it clears the chuck and can be moved out of the way to permit flat turret work close to the chuck.

The machine is regularly furnished with a flat turret but can be furnished with a hollow hexagon turret without extra charge. A taper attachment and a chasing bar can be furnished at an additional cost.

SPECIFICATIONS

Swing over bed, in.	25
Swing over carriage ways, in.	22½
Swing over cross-slide, in.	17
Hole through spindle, in.	4⅜
Maximum automatic chuck capacity, in.	4½
Maximum turning length, in.	44
Spindle speeds, r.p.m.	8 to 266
Feed range, in.	0.005 to 0.2
Horsepower required	10 to 15
Weight of machine, lb.	8,500

Bryant No. 12 Semi-Automatic Hole Grinder

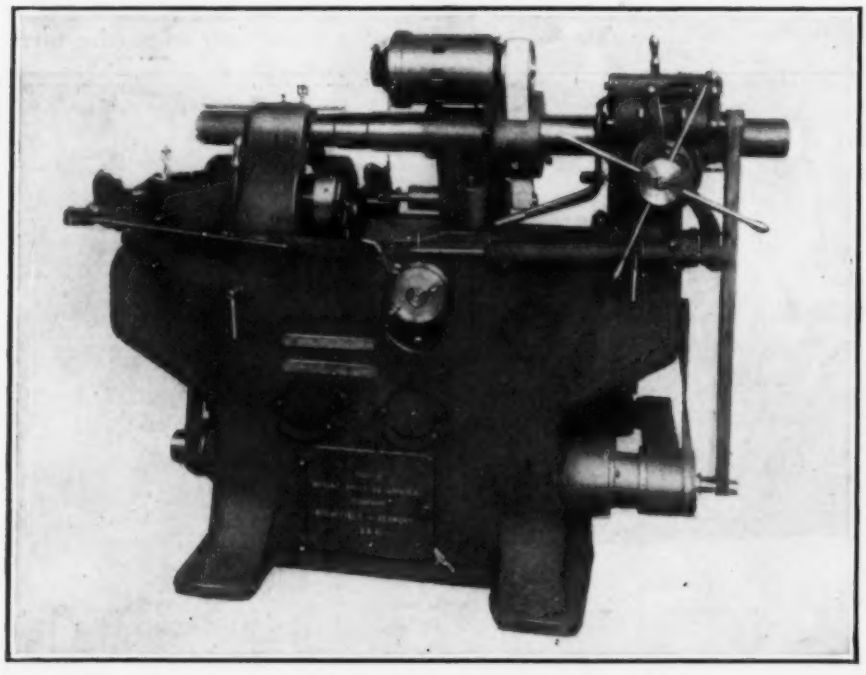
IN ORDER to supplement the smaller No. 3 Grinder previously described, the Bryant Chucking Grinder Co., Springfield, Vt., has developed the No. 12 semi-automatic hole grinder shown in the accompanying illustration. It has a 12 in. swing and an 8 in. grinding stroke and is entirely self-contained. It is particularly effective on holes 1 in. in diam. and larger.

The same suspended wheel slide construction used on other machines made by this company is retained in this model. The wheel slide is suspended from a cylinder in adjustable boxes to permit cross feed and longitudinal traverse in the same bearing. A roller cross feed screw bearing against a hardened steel bar mounted on the slide and carried well below the wheel center gives approximately a two-to-one ratio for the cross feed. It is claimed that this method of rigid wheel control results in high production and accuracy.

The wheel spindle is driven by a single belt from a 4-hp. motor operating at 3,600 r.p.m. and mounted directly on the wheel slide. An idler is provided to give maximum belt contact and ample adjustment. A second motor, rated at 2 hp. at 1,200 r.p.m. is mounted on the back of the machine and drives the main shaft from which the power is taken for the work spindle, longitudinal traverse motion, power freed, and pump. The work is driven from a cone pulley at the left end of the main shaft. Two work speeds, 200 and 400 r.p.m., are available, the change from one to the other being easily made. The slide automatically swings to the rear, giving easy access to the chuck. The traverse is by a gear sector through an intermediate shaft and circular rack. Power feed is accomplished by a cam on the traverse shaft and is adjustable.

An automatic clutch starts and stops the work as the wheel enters and leaves. Traverse and pump drives are by belt from the right end of the main shaft.

Provision is made for the use of a sizing device, and a wide variety of quick acting chucks are available and are interchangeable with earlier machines made by this company.



Bryant No. 12 Semi-Automatic Hole Grinder

Olsen-Lundgren Automatic Weighing Tire-Balancing Machine

The Tinius Olsen Testing Machine Co., 500 North Twelfth St., Philadelphia, Pa., is placing on the market the machine illustrated for balancing automobile and truck tires with accuracy on a production basis. For operation, the tire is mounted on an adapter connected to the arbor, the arbor itself forming a scale. The tire is free to move on the shaft through ball bearings, so that it will come to rest at the bottom where the greatest weight is located.

The tire and adapter is then fixed with the central shaft, which constitutes the scale, and turns 90 deg., so so the dial will automatically indicate any static unbalance in ounce-inches.

Olsen-Lundgren Tire Balancing Machine

The tire can also be operated on the shaft by power, and the amount of unbalance will be indicated automatically on the dial, and by stopping the motor at the point shown by the indicator, angle of unbalance is noted.

The machine is of compact construction, mounted on a cast-iron base. The motor is mounted on the pedestal at the rear of the machine, and the control switch is conveniently located at the side. The dial in front of the machine gives direct reading, since no corrections are necessary for

different weights of tires, as the direct mounting on the central weighing shaft gives the balance irrespective of the weight or size of the tire. The important bearings are of hardened steel, the adapter is of aluminum, and all parts are designed to retain their accuracy.

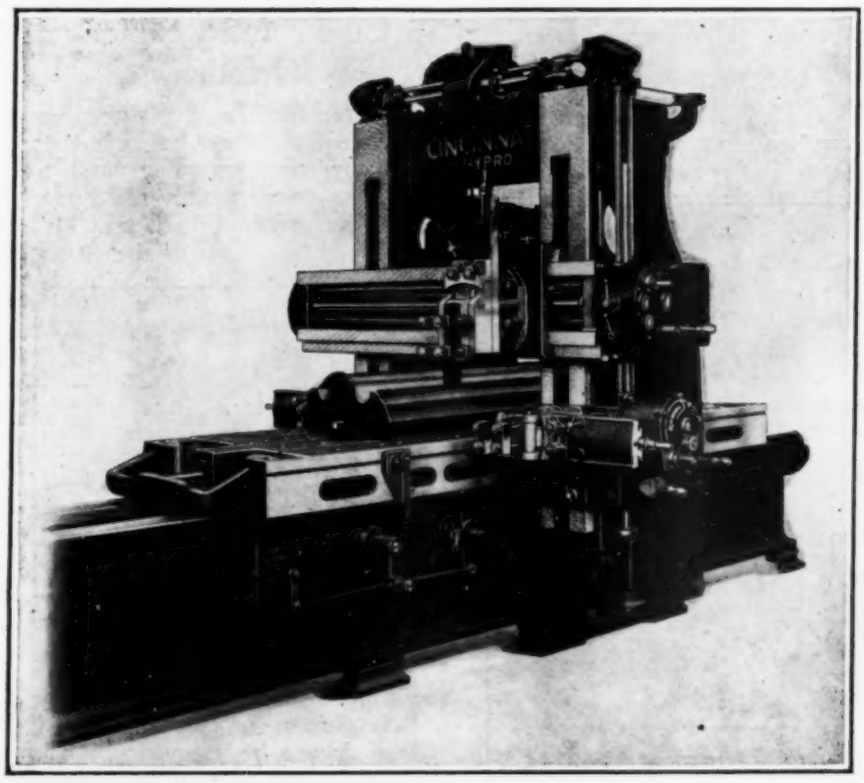
Cincinnati "Hypro" Planer for Contour Work

ESPECIALLY designed for planing irregular outlines accurately, the improved "Hypro" planer illustrated is being introduced by the Cincinnati Planer Co., Cincinnati, Ohio. It is claimed that very difficult outlines or sections with very small outside or inside radii can be planed on this machine that would not be possible with any kind of a cam or roller movement.

The planer itself includes all of the regular features of the "Hypro" planers. It has a template fastened to the rail back of the slide. This template is a piece of thin sheet brass, which can be very easily laid out, and embodies the exact profile of the work that is to be done. A small attachment back of the slide is the carrier for the tracer. This tracer does not sustain the weight of the slide nor the cutting force of the tool in any way, but merely makes contact. The making of this contact actuates an electrical mechanism that controls the movement of the tool, and makes it follow the outline of the template. The backlash in the screw is always taken up, because the tracer is always making contact on the master template. The electrical control for these movements is the regular equipment which the Keller Mechanical Engineering Corporation, Brooklyn, N. Y., is placing on its die sinking machines.

Inside of the cover, at the end of the rail, is a magnetic gear box for revolving the rail screw backward and forward. The small tracer that follows the template makes the contact to one of the points at the front. This in turn is carried to the magnetic gear box by the wire. On the opposite end of the rail is a duplicate magnetic gear box. This in turn operates on the feed rod in the center of the rail and controls the up and down movement of the slide. Both movements are controlled automatically, so that the operator need not pay any attention after the job is once set. After a cut has been taken over the work, the tracer on the template can be withdrawn and the head run back through the usual rapid traverse as regularly supplied on the planer. When ready for the next cut, it is only necessary to throw the tracer in again. All of the connections are made to the rail screw and the feed rod with the regular standard jaw clutch. A lever connected to the feed rod serves for throwing out the clutch when the rapid traverse is used to raise or lower the slide.

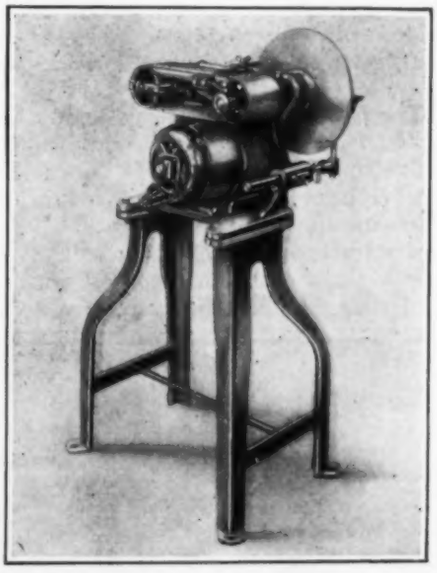
The machine is intended for any kind of irregular outline planing, and also for such work as drawing dies and drop-forge dies where two or three angles must be matched accurately. With this mechanism, it is claimed that both die and punch can be machined accurately, so that they will go together without any hand work.



Cincinnati "Hypro" Planer for Contour Work

Walls Duplex-M Abrasive Band and Disk Grinder

An improved abrasive band and disk grinder known as the Duplex-M has been placed on the market by the Walls Sales Corporation, 96 Warren St., New York City. The machine is motor driven and has the regular quick change band feature. The abrasive band can be changed quickly while the machine is in motion by pulling out the lever, thereby drawing in one pulley and releasing the band.



Walls Duplex-M Abrasive Band and Disk Grinder

The abrasive band always lies perfectly flat on the table when the lever is released. The table over which the band operates is 10¼ in. long by 5 in. wide, and is planed true to produce a

true level surface on the finishes. A 4-in. wide abrasive band is used, which can be brought to any fixed position by adjusting two thumb screws.

The grinder has a 12-in. removable steel disc and a grinding table for the disc, which may be raised or lowered or turned to various angles. Rough grinding can be done on the disk and finishing on the abrasive band, producing a straight grain finish on metal, composition or wood parts in a rough, smooth, or fine finish according to the grit abrasive band or abrasive disk used. The grinder is operated by a ½-hp. motor connected by means of a silent chain drive. The speed is 1,750 r.p.m. It occupies a floor space of 29x24 in. and weighs 225 pounds.

Gould & Eberhardt Manufacturing Shaper

A SHAPER that is claimed to combine unusual strength and rigidity with speed and power is being placed on the market by Gould & Eberhardt, Newark (Irvington), N. J. The machine is intended to be a manufacturing shaper for handling work economically on a production basis.

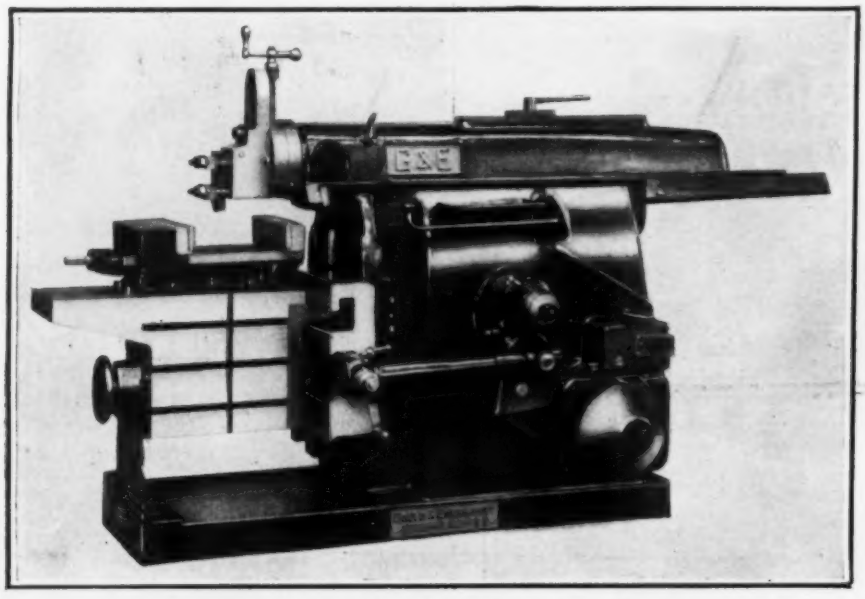
The features claimed for the improved shaper that places it in the class of a manufacturing tool, are: Single cam power feed; dual control for table hand feed; power rapid traverse to table; double crank gear; heat-treated gears; circulatory pressure oiling; anti-friction bearings; rigid and symmetrical frame; chilled ram guideways; rigid worktable guideways; direct-coupled motor; non-slip table support; and production vise.

The power rapid traverse operates at 100 ft. per min. and is controlled with a single lever. A safety slip device is incorporated. The feed is automatically disconnected when the power traverse is in operation. The machine has centralized control for feed changes, feed direction, stroke changes, stroke length, power traverse, and start and stop.

The cross-rail is clamped by means of studs through the wide front of the frame, thus practically eliminating rail deflection. The rail is guided with V guideways. The inverted work slide, and the long narrow single plate guide, are designed to reduce table deflection when taking heavy cuts, and also assure more accurate guiding.

The double crank gear transmission applied to other shapers made by this company has been retained for this model. The dual control provides hand feed at the table front, in addition to the usual control at the end of the cross-rail, the operator working in the natural position. A four-screw toolholder is provided for heavy production work, a single-screw toolholder being optional. A quick-acting block secures the head slide in any position and prevents creeping of the tool.

The pressure oiling system automatically supplies oil to each of the moving and rotating parts, including the ram guideways and the linkage system. A pressure pump distributes the lubricant from the main reservoir in the base. The motor is of the built-in type.



Gould & Eberhardt Manufacturing Shaper

Blanchard Grinding Wheels

The Blanchard Machine Co., Cambridge, Mass., is introducing a line of silicate cylinder grinding wheels especially adapted for the Blanchard surface grinding machines. The grinding wheels are made in various grades to suit the class of material, width of surface, and finish desired. The grades are designated by numbers, and a table is furnished showing the grades generally suitable for various materials.

Blanchard Grinding Wheels

Greenfield No. 3 Universal Cutter and Reamer Grinder

The Greenfield Tap & Die Corporation, Greenfield, Mass., has applied an electrically-driven grinding head to one of its standard universal cutter and reamer grinding machines. This model is to be known as the No. 3, and will be supplied with motor for electric current of any commercial voltage, phase or frequency. The attachments that go with the machine are the same as those supplied with

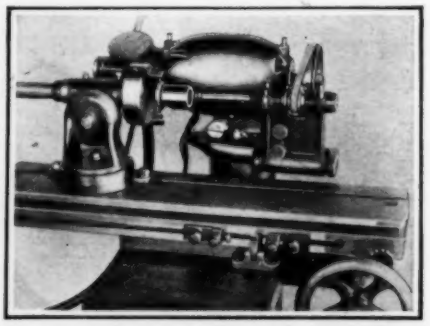


Fig. 1—Greenfield No. 3 Universal Cutter and Reamer Grinder

the belt driven machine of the same capacity.

The specifications for this machine are: vertical movement 8 in., cross-feed 6 in., length of table travel 19 in., length of piece that can be held between centers 21 in., and swing over the table 6¼ in. In this new machine, the column is rigid and the head may be turned about a vertical axis to present the wheel to the work at any desired angle.

In Fig. 1 may be seen the arrangement provided to drive the work-head. A worm-driven reducing gear, inclosed in a case is bolted to the motor case, and a flexible shaft connects it with the end of the rotor shaft. A flanged pulley, substituted for the grinding wheel, takes a small belt to drive the internal grinding spindle. The illustration, Fig. 2, shows the set-up for grinding cutters.

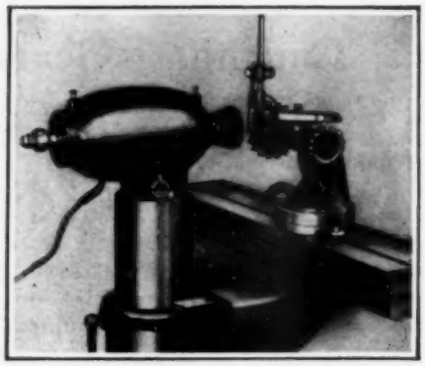


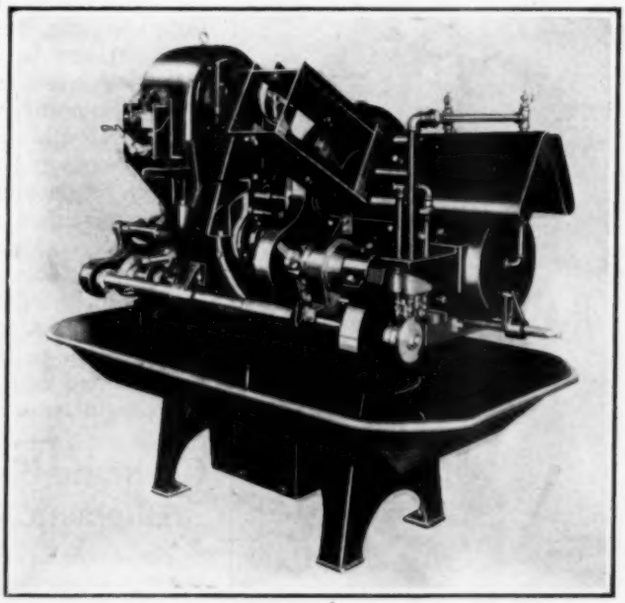
Fig. 2—Set-up to grind teeth of cutters

Rickert-Shafer Style R-S Automatic Double-Spindle Threading Machine

STANDARD 1-in. pipe nipples can be threaded at the rate of 13 ends per min. on the type R-S automatic double-spindle threading or second operation machine, made by the Rickert-Shafer Co., Erie, Pa. The production rate on other sizes of pipe nipples varies up to 25 ends per min. for ⅛-in. pipe. With slight modifications, the machine can also be adopted for the threading of other parts.

In general the unit consists of two threading spindles automatically controlled by cams and an eight-station turret mounted in a vertical plane. The vertical turret indexes automatically in time with the spindle threading movements and is driven from a backshaft. For threading of nipples the turret is equipped with air-operated collets which grip the work firmly during the machining operations. The air piston is automatically controlled and its movements can be adjusted by micrometer screws.

The cam controlling the actual motion of the spindle gives quick advance, slow cut with positive lead control, and rapid return. Two pieces are threaded at once and the turret indexes two stations at a time. The pneumatic turret mechanism includes two injector bars for inserting the nipples, two clamping bars for holding the nipples while the threading operation is in progress, and two ejector bars for automatically pushing out the completed nipples. Air control is also used to lock the turret in each position by means of an indent pin engaging a suitable tapered bushing. This indent pin carries a small straight pilot at its end to clear the hole of chips and to provide proper seating on the taper. Drive from a 3- to 5-hp. motor is recommended.



Rickert-Shafer Style R-S Automatic Double-Spindle Threading Machine

Siewek Drill Jig

Cushion clamping is the chief feature of drill jigs manufactured by the Siewek Tool & Die Co., 10232 Woodward Ave., Detroit, Mich. In Fig. 1 a photograph of the device is shown, while in Fig. 2 a cross-section view of the clamping mechanism is given. The clamp is actuated by the crank handle *H* which rotates crank pin *F*. The pin is engaged in the slot of link *A* and imparts vertical motion to it. Link *A* is held to the post *B* through a compression spring which can be regulated to produce a pressure on the work ranging from 5 to 400 lb. When the work is locked

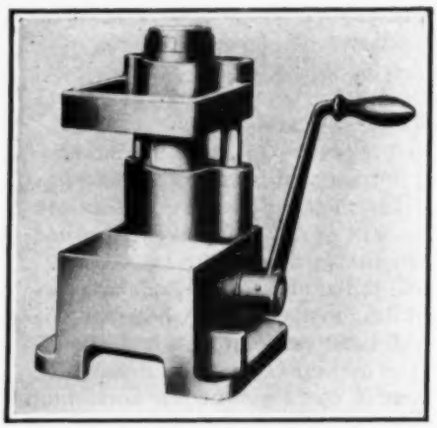


Fig. 1—Siewek Drill Jig

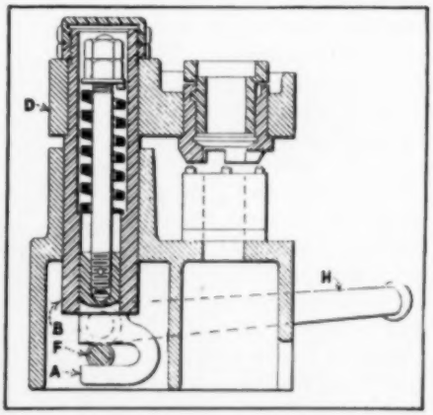


Fig. 2—Cross-sectional view of the clamping mechanism

the spring is under compression and the crank pin is on its lowest dead center position. The design is such that the only effort required to operate the jig until the bushing plate is in contact with the work on the anvil is friction and the weight of the head *D* and its component parts. At the point of clamping little effort is required because the mechanical advantage of the crank slot is greatest near the dead center position of the crank as shown in the sectional view.

The bushing plates are inter-

changeable so as to take care of a large number of different parts. The jig is made in four types both single and double column styles with the anvil space ranging from 3 to 8 in.

Gaterman Pneumatic Oscillating Tapping Machine

The pneumatic oscillating tapping machine shown has been placed on the market by W. Gaterman Manufacturing Co., Manitowoc, Wis. It operates on the same principle as the machine described on page 182, Vol. 64, of the *American Machinist*. The improvements, however, include a box-type construction, a six-speed geared transmission and the use of sub-assembly units.

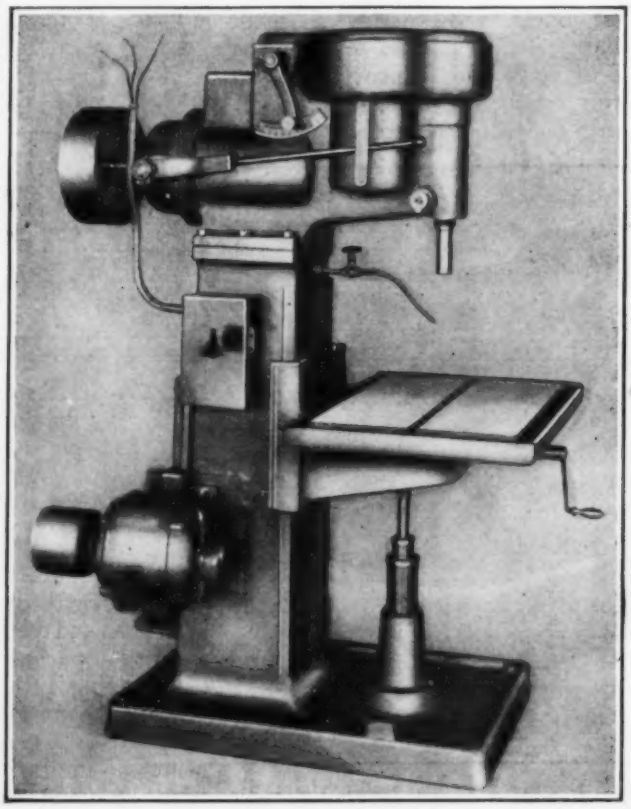
All operating parts of the machine are housed within cast-iron housings so that their lubrication is obtained by a bath of oil. The oil is furnished by both splash and force feed.

All radial and thrust loads are carried on Timken roller bearings, of which twenty-two are used.

The speed-change transmission, which is contained in the horizontal barrel, and the forward and reverse-clutch transmission contained in the vertical barrel, are built as separate units and then are inserted into the head of the machine as a complete assembly. This feature enables adjustments or repairs to be made more easily since the unit can be removed from the head without dismantling other parts of the machine.

An advantage claimed for this construction is that an extra set of units can be carried in stock so that should a machine fail, due to injured units, it would only take a comparatively short time to remove the unit and replace it with the emergency unit.

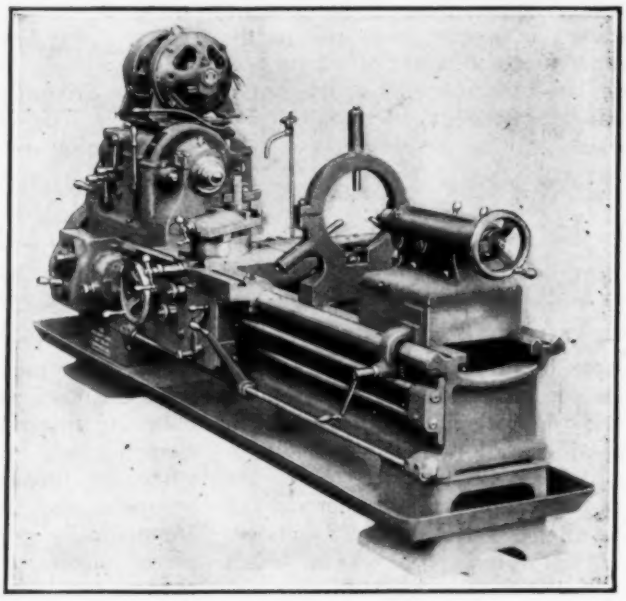
The capacity of the machine is from $\frac{1}{4}$ to $1\frac{1}{4}$ in. The weight of the machine is 1,500 lb. approximately.



Gaterman Pneumatic Oscillating Tapping Machine

Cincinnati Geared-Head Lathes

A LINE of single-pulley drive, geared-head lathes was recently developed by the Cincinnati Lathe & Tool Co., Cincinnati, Ohio. The lathe can be furnished in sizes to swing work $16\frac{1}{2}$ to 32 in. in diameter. Sixteen spindle speeds are available in these machines and they can be selected instantly by simply shifting a lever. All gears in the patented geared head are made of forgings of a special manganese-chrome alloy steel, heat-treated in oil and ground. The gears are all contained in the lower half of the housing which is of box type construction, heavily ribbed and clamped to prevent chattering. This housing also forms a reservoir for the oil. The bottom part is a sediment basin through the lower point of which the oil may be entirely drained, when it is desired to put clean oil in the headstock. A sight gage is located in the rear to show the level at which oil is to be maintained at all times. All bearings except the main spindle bearing are amply lubricated by the splash system, even when operating at the lowest speeds. It is claimed that none of the oil leaks out through the bearings. The main spindle bearings are oiled separately through convenient sight-feed oilers.



Cincinnati Geared-Head Lathe

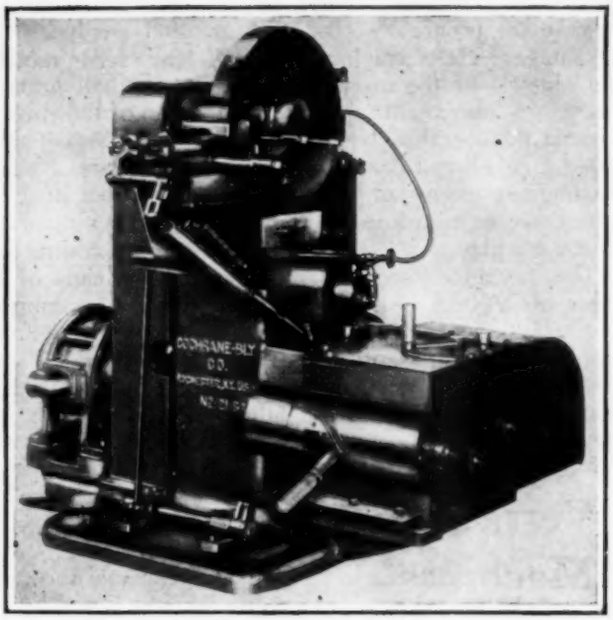
The clutch or driving mechanism is an integral part of the housing. Because of the reduced overhang the drive shaft is relieved from bending strain. The driving mechanism is said to be efficient and reliable as few parts comprise the unit. Adjustment for wear can be made by loosening a locking screw and moving a ring nut. The clutch is of the compression disk type and it transmits the full horsepower rating of the motor. It may be operated from the apron lever, convenient to the operator or from a lever located on top of the headstock. This same lever is also actuated when the gear changes are made to avoid gear clash.

The single-pulley belt model may be converted over to motor drive at any time after installation.

Cochrane-Bly No. 21 Semi-Automatic Cut-Off Saw

The Cochrane-Bly Co., Rochester, N. Y., is placing on the market the No. 1 semi-automatic high-speed cut-off saw illustrated. The machine is intended for sawing non-ferrous

metals, light gages of steel tubing and shapes. The No. 21 saw is provided with a quick-change gear box, giving six changes of speed up to 50 ft. per min. It is also arranged for change gears to give a variety of speeds suitable for the work in hand. The gear box contains a friction safety drive by which it is possible to regulate the pressure of the saw against the work. The machine is operated through a positive pin clutch, worked with a treadle, which can be locked for continuous running. The vise is automatic, opening and closing with the movements of the saw carriage, and releasing the cut piece on the return stroke of the carriage. This permits the feeding of the bar through the gage before the next forward movement. A geared pump delivers the coolant to the blade.



Cochrame-Bly No. 21 Semi-Automatic Cut-Off Saw

Diamond Face Grinding Machine with Oil-Driven Table

THE Diamond Machine Co., Providence, R. I., recently completed a face grinding machine having a capacity for workpieces 84 in. long by 24 in. high. It carries a 30-in. segmental wheel upon a spindle that is rotated at a speed of 375 r.p.m. by a 40-hp. ball-bearing electric motor, driving through a 7½-in. silent chain. The spindle runs in plain bronze bearings, front and rear, that are 5 in. and 4⅜ in. in diameter, respectively.

The work table of this machine is 152 in. long by 24 in. wide, of which a working surface of 84 by 24 in. is machined and provided with five T-slots for ¾-in. bolts to facilitate setting and securing the work. The remainder of the length of the table is taken up with pans, channels and guards to confine the splash from the wheel. Castings much larger than the specified grinding area can be accommodated if they are to be ground upon only part of their surfaces.

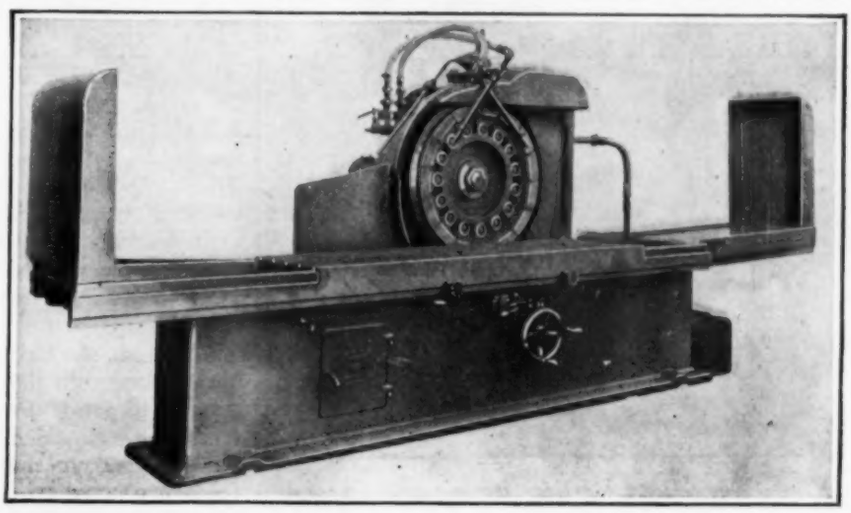
Power to traverse the table is supplied by a 5-hp. electric motor, located in the base of the machine, having its rotor shaft coupled to the rotating member of a variable-delivery pump. Oil from this pump is passed through a hydraulic motor, the speed of which depends wholly upon the amount of oil delivered to it by the pump. By the movement of a control lever located conveniently to the operating position, the delivery of oil may be varied from zero to the maximum capacity of the pump, which is calculated to impart a table speed of 72 ft. per minute. The hydraulic motor drives the table through a train of gearing, bull-wheel and rack. Gears and rack are of steel with cut teeth. Width of bull-wheel and rack is 2½ inches.

The grinding-wheel head takes its bearing upon a side extension, or integral column, midway of the length of the bed, and has a cross movement of 2⅝ in. at right angles to the table travel. Automatic feeds having a range from 0.001 to 0.010 in. are provided for this movement, which has the effect of moving the grinding wheel directly toward the work. This feed may be operated by hand, for which purpose a large-diameter handwheel is so geared to the cross-screw that one full turn of the wheel advances the slide ⅛ inch.

For the reason that in face grinding the wheel must be presented to the work at a slight angle, the bearing pedestals of the grinding-wheel spindle are a part of a casting that is separate from, yet bears upon, the cross-sliding member. The upper member swivels about a fixed stud that is located as nearly as conditions will permit to the plane of the wheel face.

An eccentric rotatable stud near the opposite end of the member provides means for making the angular adjustment easily and accurately when necessary. The wheel driving motor is mounted upon the upper member so that any alteration of the angular position of the latter does not affect the alignment of the sprockets.

A separate tank, with baffle-plates, strainer and settling basin, is provided to hold the soda water or other cooling liquid used upon the wheel and work. The circulating pump is an independent unit with individual motor drive, capable of delivering 90 gal. per min. of the coolant. Suitable flexible conduits and adjustable



Diamond Face Grinding Machine with Oil-Driven Table

nozzles direct the flow of liquid to the point of contact of work and wheel.

A wheel-dressing device is permanently mounted in the hood that covers the wheel, and is operated by means of a lever that may be seen in the illustration. Since the position of the dresser is fixed with relation to the grinding wheel, adjustment or movement of the latter in any direction does not interfere with the relative position, and the dresser is always ready for service.

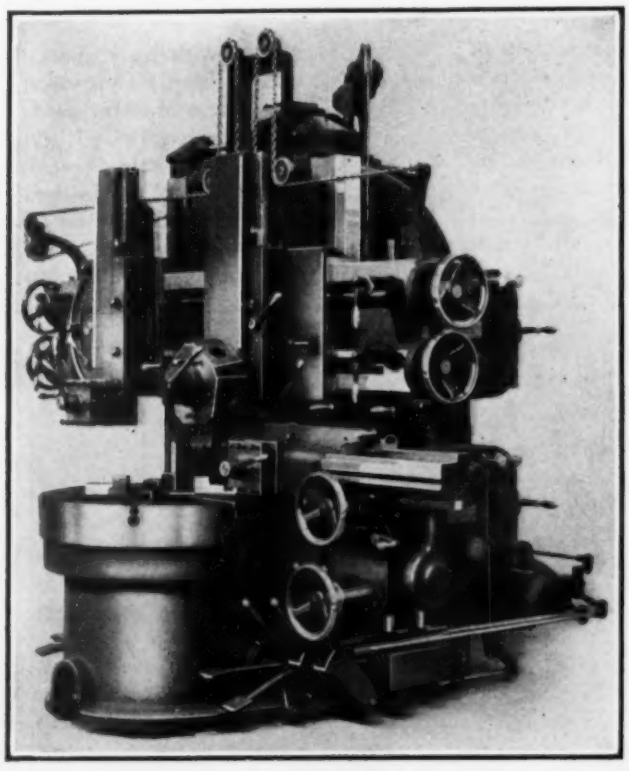
The operator's position is behind the table as the machine is here shown, and is immediately beside the cross-sliding member where he can observe the progress of the work to advantage. Here are located all of the controls of the machine, so that any of its movements may be made without the operator changing his position. Additional control levers for starting, reversing or stopping the table traverse are placed on the front of the machine.

The machine occupies a floor space of 27 ft. 5 in. by 7 ft. 10 in., and weighs approximately 16,000 lb. with all motors in position. It will also be made in a 36 in. size, with the same floor dimensions and slightly increased weight.

King Heavy-Duty, Vertical Boring and Turning Machines

AN IMPROVED line of heavy-duty, vertical boring and turning machines in 30-, 42-, 52-, 62-, 72-, 84- and 96-in. sizes is announced by the King Machine Tool Co., Cinncinnati, Ohio. The improved line departs from the standard, principally in the construction of the drive and feed mechanisms.

The gears in the drive are made of steel and all the pinions of alloy steel, heat-treated. The shafts have been increased in diameter to enable them to transmit the greater carrying capacity of the gears, and in order to reduce wear to a minimum the dimensions of the gears are the same in steel as was formerly the case in cast iron. A multiple-disk friction clutch is used for engaging the drive and when disengaged a brake automatically brings the table to rest. Two treadles are used to control the machine and are placed on both sides when two rail heads are furnished, one for starting the table and the other for stopping it. These treadles are arranged so that when one is pushed down the other comes up; hence there is no confusion on the operator's part as to which treadle to move to either start or stop the table. These treadles are conveniently located. The entire drive mechanism, as well as the spindle and conical seat of the table are all automatically lubricated by means of oil pumped through a filter, from which it flows to the various bearings and gears. The feed devices, which are independent for each head, are all concentrated in boxes bolted to each end of the rail. The gears in the feed mechanism, with the exception of the friction gears which serve to engage the feeds are made of steel, while the sliding gears are made of alloy-steel and are heat-treated. The shafts in the feed mechanism are mounted upon ball bearings, and the lubrication of the entire unit is accomplished by the splash system. Twelve rates of feeds are available, ranging from a minimum of 1/96 to a maximum of ½ in. per revolution of the table.



King Heavy-Duty Vertical Boring and Turning Machine with Side Head Attachment

The control of the feeds is made at the ends of the rail and separate levers are employed for the vertical and horizontal feeds, so as to prevent confusion. These levers, besides engaging the feeds, determine the direction of same, as well as the rapid traverse, and either one or both feeds may be engaged at a time. The same statement also applies to the rapid traverse control.

A screw-cutting attachment is available for cutting the usual pitches from 2 to 12 threads per inch.

These machines may be equipped with one or two heads on the rails, and either with or without a side head. The side head is fitted directly to the column and has an entirely independent feed and rapid traverse for controlling its vertical and horizontal movements. The side head is made heavy enough to permit taking large cuts. Two swivel heads may also be provided on the rail, or a right-hand vertical turret and a left-hand swivel head, or simply a single swivel turret, which is usually used in conjunction with a side head. For manufacturing purposes the left-hand head is not required for boring purposes and a four-position tool holder may be substituted. This arrangement permits the machine to use three heads on certain classes of work, such as pulleys and gears. In this case the right-hand vertical turret is used for boring and facing the hub, the left-hand head for turning the periphery, and the side head for turning the upper and lower face of the gear or pulley.

The rails and saddles are equipped with scales and the handwheels have micrometer collars to simplify the positioning of the tools. The side head is equipped with a horizontal scale for the ram and micrometer collars on both handwheels.

A small constant-speed motor is used for driving the rapid traverse and the elevating mechanism of the machine. Arrangements are provided to stop the elevating mechanism before the rail reaches the limits of its travel either up or down. Automatic stops are also provided for the vertical travel of the side head and the outward travel of the saddles on the rail.

Cincinnati Bickford "Super-Service" Production Drill

THE Cincinnati Bickford Tool Co., Oakley, Cincinnati, Ohio, has placed on the market the "Super-Service" production drill illustrated. The machine is intended to meet the specific requirements of the automotive and other mass-production industries, and is essentially a one-speed, one-feed, single-purpose machine. It is stripped of the features usually found on general-purpose machines, but flexibility has been obtained in the design, so that by merely transposing gears 16 speeds and 16 feeds can be obtained.

The forward and reverse driving clutches that comprise the tapping attachment are located on the main driving shaft. These clutches have high-power transmission capacity and run at constant speed. These clutches are of the internal expanding type, and are mounted on a continuous sleeve supported at each end by double row, New Departure ball bearings. The clutch mechanism runs in oil.

The speed gear train consists of four cluster gears of two gears each, which are interchangeable on three vertical shafts, so that sixteen gear combinations are possible. The speeds are graded, and range from 263 to 1,233 r.p.m. The gears are of heat-treated alloy steel, and each shaft is multiple splined and revolves in New Departure ball bearings.

The feed gear train is composed of four cluster gears of two gears each. These cluster gears are interchangeable on four vertical shafts, giving sixteen closely graded feeds ranging from 0.0004 in. to 0.025 in. Both gears and shafts are of heat-treated alloy steel, and the feed gear train is lubricated by a splash system. The gears and shafts in the gear train are numbered for easy identification.

The spindle of the "Super-Service" drill runs in roller bearings. The upper bearing is Timken, and the lower is a Hoffman. The feed pressure is taken by a large ball thrust

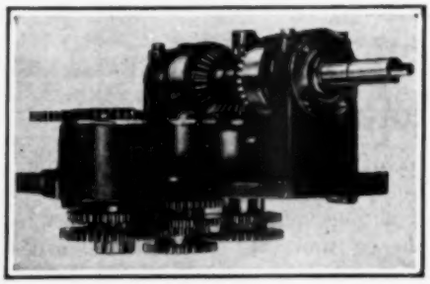
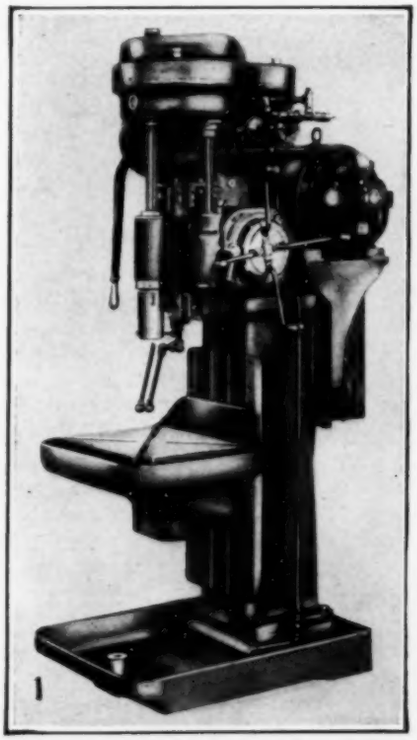


Fig. 3—Drive mechanism for the spindle



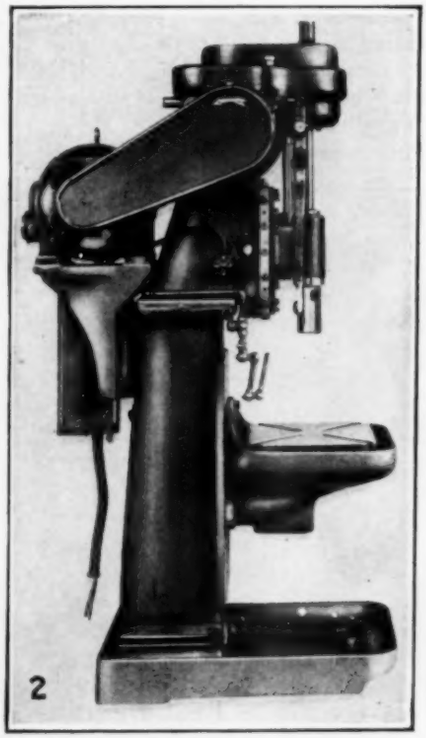


Fig. 1—Cincinnati Super-Service Production Drill. Fig. 2—Rear View of the Machine

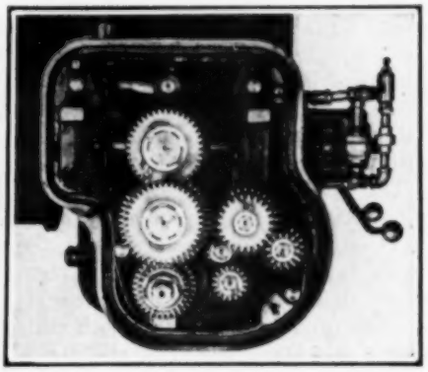


Fig. 4—View of the gear train

bearing. These bearings are packed in grease and require oiling attention only once in two or three months. The spindle is of special alloy steel, and is multiple splined. The spindle is attached to a slide, giving stiffness and rigidity at the spindle nose.

There is claimed to be no need for frequent vertical positioning of the work table on a machine of this type, and the usual raising and lowering mechanism has, therefore, been eliminated. The table is bolted to the face of the column, and holes spaced at close intervals permit of positioning the table according to the work to be done. This class of table is claimed to give greater rigidity. The column is of a heavy rectangular type, and consists of two sections. The construction permits of inserting raising blocks of various heights between the two sections when greater distances from the spindle nose to the work table are desired. For gang drill construction, it is merely necessary to mount the required number of upper sections on a common base.

The work table is surrounded by a deep, wide groove of large chip capacity, which is connected by large cored openings with a discharge on the under side of the table. Chips and cutting lubricant pass through the table and are discharged into the steel hopper beneath. The lubricant pump is driven from the main driving shaft and runs at a constant high speed.

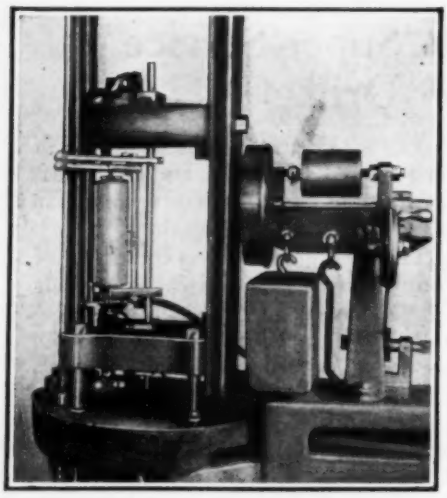
The motor drive is through an inclosed silent chain running in oil. The motor recommended is 5 hp., 1,200 r.p.m., constant speed.

Olsen-Smith Stress-Strain Recorder

The Tinius Olsen Testing Machine Co., 500 North Twelfth St., Philadelphia, Pa., recently developed the stress-strain recorder shown in the illustration, which may be attached directly to the test specimen,

giving a graphic stress-strain diagram from which the modulus and elastic limit may be accurately secured. The recorder is shown attached to the test specimen in a standard Olsen universal testing machine.

The chief purpose of the apparatus is to record on paper the relation of the elongation to the load, and the result is a highly magnified stress-strain diagram. The instrument is portable, and is clamped to both ends of the test specimen after the specimen is clamped in the machine. The lifting of the pencil to record the height is controlled through a flexible shaft connected with the balance scale of the machine. The height, therefore, registers the load as indicated by the scale. As the specimen elongates, the movement sets in motion a magnetic motor at the bottom of the apparatus, automatically rotating the drum an amount in direct proportion to the elongation of the specimen.



Olsen-Smith Stress-Strain Recorder

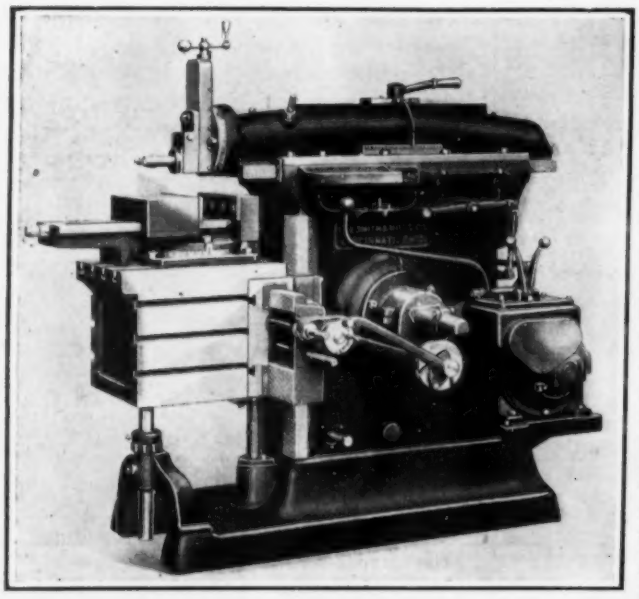
The movement of the pencil in synchronism with the movement of the scale and the elongation of the specimen, thus gives a true diagram of the stress strain.

Smith & Mills 25-Inch Back-Geared Crank Shaper

A 25-IN. back-geared, motor-driven crank shaper for heavy-duty work has been placed on the market by the Smith & Mills Co., Cincinnati, Ohio. The improvements incorporated in the 25-in. machine have also been made in the 16- and 20-in. machines built by the company. The shapers are also regularly furnished for belt drive, either with speed box and single pulley or with the cone type of pulley.

All gears in the speed box and inside of the column, with the exception of the main gear, are of the cluster type of hardened alloy steel. All sliding gears are broached, and slide on multiple splined shafts of high-carbon steel, mounted on Timken tapered roller bearings. The internal ratchet feed, with drop-forged pawl and trip, are inclosed inside of the feed gear. A solid feed rod is provided with a graduated feed disk. The machine is equipped with a single screw parallel-jaw type vise with graduated swivel base.

The shaper illustrated has a speed box motor drive of the constant speed type, direct connected by means of a fiber pinion to a large gear on the driving shaft of the machine. The gear is mounted on tapered roller bearings, and the drive is transmitted through a twin disk clutch. The clutch and the self-acting brake are controlled by a single ball lever. Eight cutting speeds are provided by the speed-change box and back gears, control being by two convenient levers.



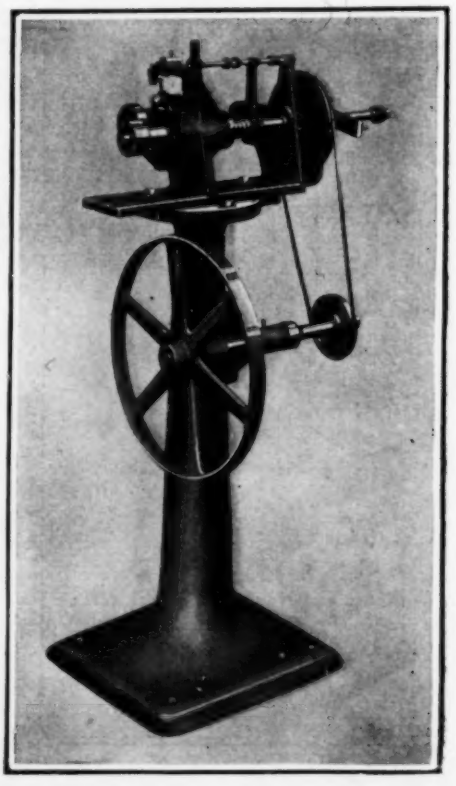
Smith & Mills 25-Inch Back-Geared Crank Shaper

The lubricating system is arranged to supply fresh oil to all main revolving shaft bearings and ram ways, as well as to the parts on the inside of the machine. The foot plunger for the oil pump is on the outside of the machine, within easy reach of the operator. The 25-in. shaper shown is equipped with a 7½-hp. motor, including a starter and push-button control.

Standard Machinery Co. Traversing Reel

This traversing reel, built by the Standard Machinery Co., Auburn, R. I., is designed to be used for spooling wire as taken from a small rolling mill or wire-drawing machine. The spool on which the material is being wound is traversed back and forth by means of a train of gears, an adjustable eccentric disk and a nut which is operated by ratchets and pawls. This mechanism is driven by the spool shaft and therefore coils the wire evenly regardless of the steadily increasing diameter of the spool.

The amount of traverse per turn of the spool can be varied by adjusting the eccentric disk. The traversed motion reverse can also be adjusted at the end of the spool so as to suit any diameter of wire. This traverse motion reverses instantly, eliminates any building up of the material at



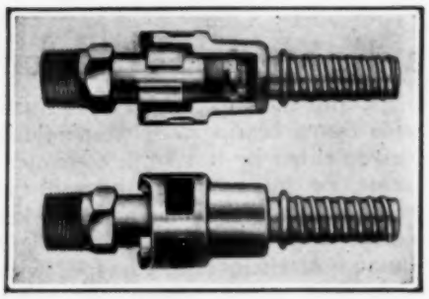
Standard Machinery Traversing Reel

the end of the spool, and insures a compact package which will unwind readily, it is claimed. These reels are built in two sizes, and cover a range from very small wire or flat, up to diameters or widths as large as $1\frac{9}{16}$ inch.

Robinson "Superior" Air Hose Coupling

The Robinson Machine Co., Muskegon, Mich., has placed on the market the "Superior" plain-type air hose coupling illustrated. It is made without springs or loose parts, and is connected with one-quarter turn.

A special treated leather gasket is employed, and is expanded by a V-shaped ring when the air pressure is applied. This is claimed to make it a pressure-seated air hose coupling and positively air-tight under any pressure conditions. The gasket is claimed not to stick or corrode nor to pull out of the coupling, and can be adjusted for wear by a slight turn of the nut. The couplings are made interchangeable in $\frac{3}{8}$-in., $\frac{1}{2}$-in. and $\frac{3}{4}$-in. sizes.



Robinson "Superior" Air Hose Coupling

Pels 220-Ton Type Pr Plate Frame Press

THE frame of this press, built by Henry Pels & Co., Inc., 90 West St., New York, N. Y., is built up of two heavy open-hearth steel plates connected by a heavy cast-steel anchor and various separators. The anchor is a solid steel casting entirely surrounding the throat, and it serves as a lower platen, ram housing and front bearing for the eccentric shaft. A rear bearing for the eccentric shaft makes an additional reinforcement. The press is so designed that all bolts connecting the frame plate, anchor and separators are relieved from the pressure of operation. It is claimed that they will not become loosened.

Individual motor or belt drive can be used, there being a single gear reduction between the flywheel and eccentric shafts. The pinion is cut from solid steel and drives a cast-steel wheel. The ram is counterbalanced. Both platens are large and have T-slots for holding dies. A large slug hole is left in the bottom platen. The stroke is easily adjusted, but non-adjustable rams can be provided, if desired.

A shear plate is provided between the punch and die and is so proportioned that if the maximum permissible pressure is exceeded the shear plate is penetrated by the punch as Fig. 2 clearly shows.

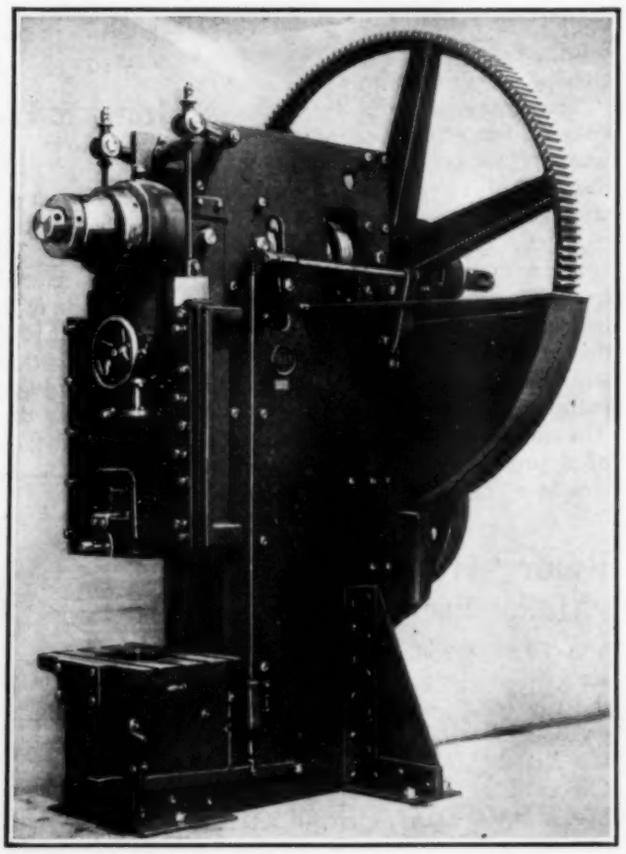


Fig. 1—Pels 220-Ton Type Pr Plate Frame Press

A foot trip operates the clutch but the machine stops automatically after each stroke even if the operator fails to remove his foot. The foot trip can, however, be set for continuous operation. The clutch used has three jaws and permits starting the ram within one-third revolution of the eccentric shaft. A rebound lock pin eliminates the shock that frequently is of considerable annoyance in either bending or pressing. A safety pawl on the clutch protects the gear and other members from damage. A band brake on the eccentric shaft stops the ram in its highest position.

The shaft and pinion are made of forged open-hearth steel while the plunger, ram, anchor, gear wheels, separators, and bearings are of cast steel. Gears are cut from the solid; shafts and bushings are ground; and all bearings have bronze bushings. The high-speed flywheel shaft has adjustable ring oiler bearings. The general dimensions are:

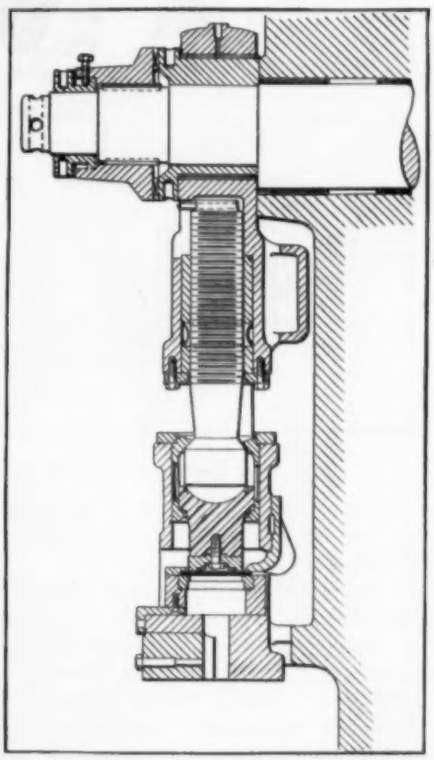
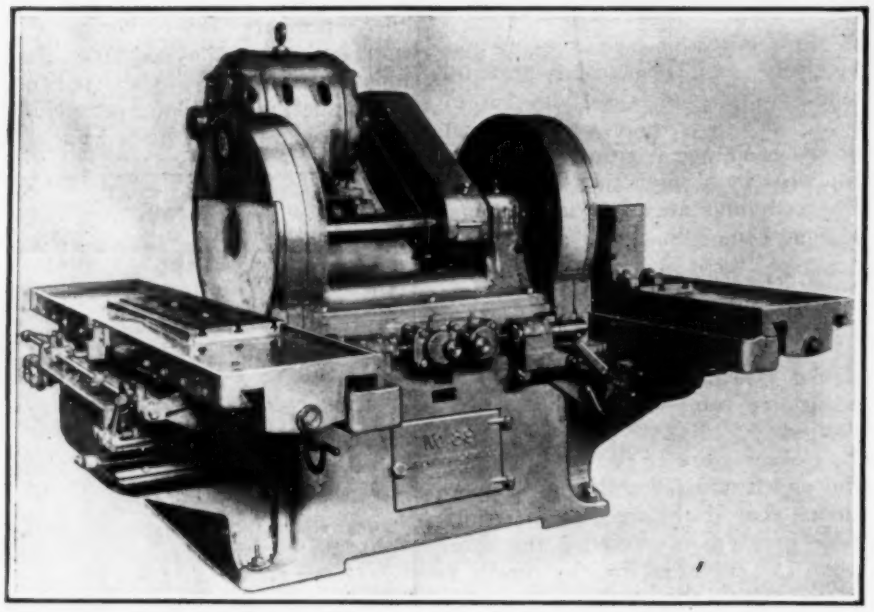


Fig. 2—Cross-section of the ram showing safety shear plate

Pressure, tons	220
Depth of gap to center of platen, in.	12
Top platen, in.	34x14
Bottom platen, in.	32x22
Maximum distance between platens, in.	17¾
Length of stroke adjustment, in.	¾ to 4
Strokes per minute	30
Horsepower required belt drive	10
Approx. floor space, in.	96x112
Approximate net weight, lb.	19,250

Gardner No. 89 Hydraulic Surface Grinder

THE Gardner Machine Co., Beloit, Wis., recently brought out a hydraulically-operated surface grinder, designated as No. 89, that is suited for the grinding of a wide variety of parts having flat surfaces. It is particularly adapted to the handling of pieces having two or more surfaces to be ground, but which are in such relation to each other that they cannot be efficiently finished simultaneously.



Gardner No. 89 Hydraulic Surface Grinder

The machine has two hydraulically-actuated work tables, and one head that supports two abrasive cutting members. It is intended for high-production work, being semi-automatic in operation. The tables are so arranged that one operator can serve both of them, and they can be operated either simultaneously or alternately, depending upon the nature of the work. If required, the tables can be so fixed that two operators can be employed without interference with each other. Both work tables are designed so that all movements are predetermined to suit the specific work, and are controlled, after being so set, by one hand-operated lever placed within the convenient reach of the operator. All traverses of the table are produced by a hydraulic power unit. These various traverses have full micrometer stop adjustment.

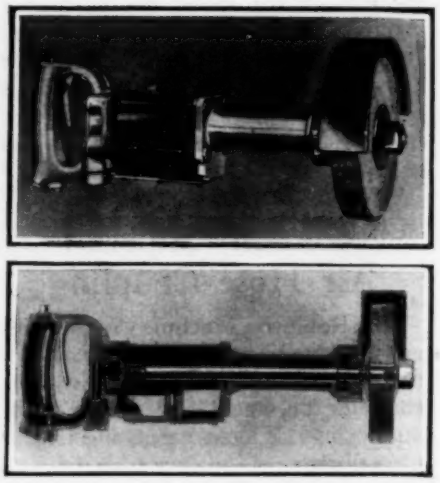
The abrasive members are carried on opposite ends of a heavy spindle. The spindle is mounted on ball bearings of such design that the radial load is carried by radial bearings, and the thrust load by adjustable thrust bearings. The spindle is driven either by belt from a countershaft, or by a motor through the medium of a silent chain and sprocket completely inclosed in an oil-tight dust-proof chain case, equipped with sight-feed oilers. With the latter construction the chain and the spindle bearings can be inspected without altering the adjustment of the spindle.

The abrasive members consist of either 30-in. steel disk-wheels faced with the heavy type Gardner G.I.A. disk, or 24-in. chucks carrying abrasive ring wheels.

If the equipment is supplied in belt drive, both the spindle and the hydraulic power unit are driven from one countershaft, and if it is motor driven, a 25-hp. motor for the spindle, and a 5-hp. motor for the hydraulic pumps, provides the necessary power. The machine occupies a floor space of approximately 9x10½ ft. and the weight is 10,500 pounds.

Rotor "High-Production" Model D-1 Air Grinder

A "High-Production" Model D-1 air grinder, designed exclusively for the use of rubber-bonded Redmanol or Bakelite wheels is announced by the Rotor Air Tool Co., Cleveland, Ohio. The machine operates under load at 5,400 r.p.m., giving 8,500 surface ft. per min. as recommended for this type of wheel and endorsed by the Safety Code. Free speed without load is controlled by a quick-acting governor that cuts off the air at 5,800 rev. per minute.

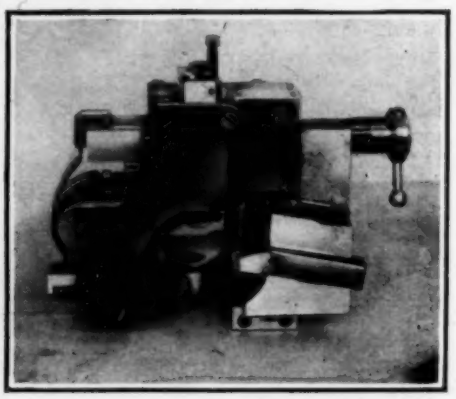


Rotor "High-Production" Model D-1 Air Grinder

The rotors shown in the illustration operate in a film of oil and do not touch the cylinders. The spindle runs in ball bearings. The exhaust and inlet sides are sealed by the fiber blade riding on the chrome-nickel steel rotor. This construction concentrates wear on the fiber blade which can be replaced in 5 min. and at low cost, it is claimed. With rubber-bonded wheels, an increase in cutting ability of 30 to 50 per cent on cast iron is claimed.

Jones & Lamson Model M Taper Turner

Tapers may be turned either from the rough bar or from the finished stock in the Model M taper turner recently placed on the market by the Jones & Lamson Machine Co., Springfield, Vt. The illustration shows the turner set up to turn tapers from the rough bar, in which case the rolls follow the cutter. When tapers are turned from finished stock where



Jones & Lamson Model M Taper Turner

the bar is first turned straight, the rolls precede the cutter and bear upon the surface previously finished.

The unit is provided with adjusting screws for the rollers and with a side adjusting knob for regulating the taper angle of a template, and hence the work. The template is the same size and shape as has been used on the Model K taper turners made by this company. The angle of taper on the template should be set to one-half the included angle of the desired taper on the work.

A cutter of 1-in. square stock is used and the point protrudes about $1\frac{1}{16}$ in. from the slide and is set at the center of the work. The cutter can be adjusted for height by a screw directly under it. After it is placed, the rolls are adjusted to it. These rolls are made with one edge slightly chamfered and the other edge ground to $\frac{1}{8}$-in. radius. For very shallow tapers, the sharp corner of the roll is next to the cutter, but when turning steeper tapers the round corner can be used.

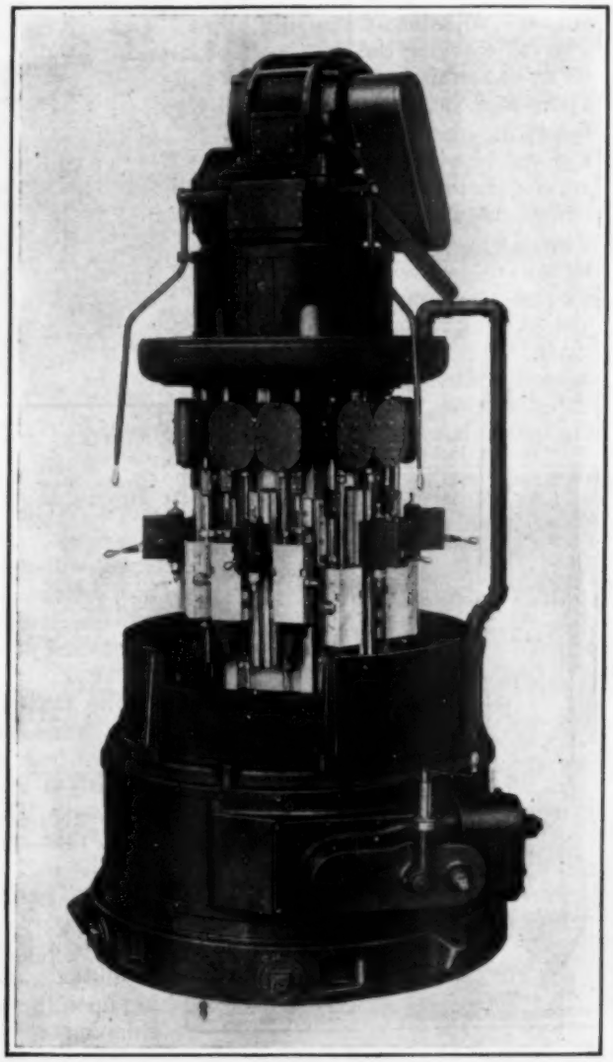
In adjusting the rolls, a short taper is first turned on the bar and then the rolls adjusted to it.

When the turner is used with the rolls preceding the cutter, the cutter is made of $\frac{1}{2}$x1-in. steel stock.

Bullard Contin-U-Matic Center Lathe

FOR the machining of work held between centers in a vertical position, the Bullard Machine Tool Co., Bridgeport, Conn., has developed what is known as a Contin-U-Matic center lathe. It is an automatic multiple-spindle production machine and, in basic principles, is similar to the six-spindle Contin-U-Matic chucking machine. There are six work spindles in a carrier and six tool heads mounted upon a hexagonal tool column built integral with the carrier. The respective spindles and tool heads always remain in direct relation to each other and form six individual units that, in operation, are rotated slowly around the central column. One complete cycle is required for the chucking, the machining and the unloading of a single piece, but six units are produced during the cycle time. In the Contin-U-Matic center lathe a tailstock with center is mounted on the upper portion of the tool support column and may be varied in height to suit the length of the work. The maximum capacity is approximately 20 in. on the standard machine, but may be increased when occasion requires by an extended height of the column.

Spindle speeds available include a complete range up to a maximum of 300 r.p.m. and may be obtained by change gears in the drive bracket. Any set speed is common to all spindles.



Bullard Contin-U-Matic Center Lathe

In diameter of work the machine has a maximum capacity of $9\frac{1}{4}$ in. swing under the tool slides and $5\frac{1}{4}$ in. maximum diameter clearance between tool slides.

All tool heads are actuated by a common cam mounted at the head of the machine that provides for a rapid advance of the heads to point of cutting, a period of feed at a predetermined set rate, and a rapid return with a short dwell at the high point to permit the unloading and chucking of work. Primary feed motion from this cam is transmitted through secondary speed boxes mounted on the face of the tool-support column to two tool slides at either side of the center. Each slide may be independently set for either plain vertical or plain horizontal stroke with rapid advance and feed of predetermined rate and length. In combined motion, however, each slide will advance horizontally to the work, traverse vertically along the cut, withdraw from the work at the bottom of the stroke and return in rapid motion to its original position.

The maximum length of plain vertical stroke is somewhat over 9 in. and the maximum horizontal stroke is $1\frac{3}{4}$ in. In combined horizontal and vertical traverse the compounding requires 3.66 in. of vertical rod motion per 1 in. of horizontal traverse. By deducting the amount of vertical motion necessary for the horizontal traverse required, the balance of the maximum 9 in. stroke is available for direct vertical feed of the slide. The slower horizontal tool feed is of advantage when the tool is nosing its depth into the work, but vertical feed along the cut is taken at the standard set rate.

This arrangement of tool slides in each head provides for a considerable variety of independent tool application grouped in each unit and the two independent slides of each head will therefore accommodate an extensive variety of grouped operations performed simultaneously.

When necessary for the special holding of work a power-operated mechanism can be provided with the machine for actuating chuck or special work-holding fixtures. A special design of tailstock operated with one motion of the hand lever facilitates the holding of ordinary work between centers.

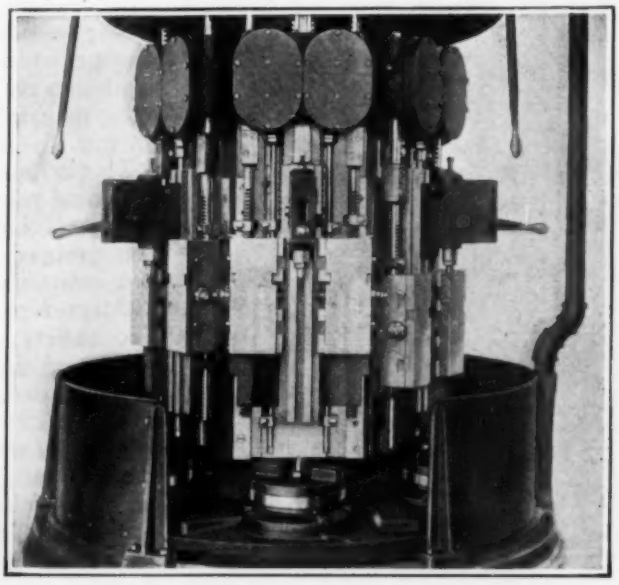
The machine operates in every way

quite similar to the Contin-U-Matic chucking model in that the cycle is divided into two sectors: the first is a loading sector occupied by the rapid-return high dwell and rapid advance of the tool heads during which time the spindle is stationary and the finished piece may be unloaded and the rough piece chucked. The machining sector occupies the greater part of the cycle during which the work spindles revolve and the cutting operations are in process. The cycle time for various classes of work can be varied from 1 to 15 min., as required and rates of tool feed may be set within a considerable range and directly applicable to the job.

In operation the machine can be completely controlled from one position while main-drive clutch levers are provided at three different points about the cycle. Control of the carrier motion is through a lever located to the right of the loading sector and this lever through independent clutch and back shaft engages power for either forward or reverse movement of the carrier. Provision is also made for hand movement when necessary.

Lubrication of the Contin-U-Matic center lathe is of standard Bullard design with constant flow to all operating parts within the machine and pressure lubrication to external units. At several points throughout the construction, devices for protection of the mechanism against over-strain or carelessness have been incorporated in each unit as well as at central points. There are no rapidly-moving parts exposed.

A cutting-compound system provides constant circulation from the base to a distribution trough at the head of the machine, thence to the tools through a filter for the removal of chips, and finally to the base for further circulation. Power requirements of the machine will range from 10 to 20 hp. Facilities are provided for motor drive with sprocket and chain connection to the main drive shaft. A constant-speed motor, either a.c. or d.c. may be used.

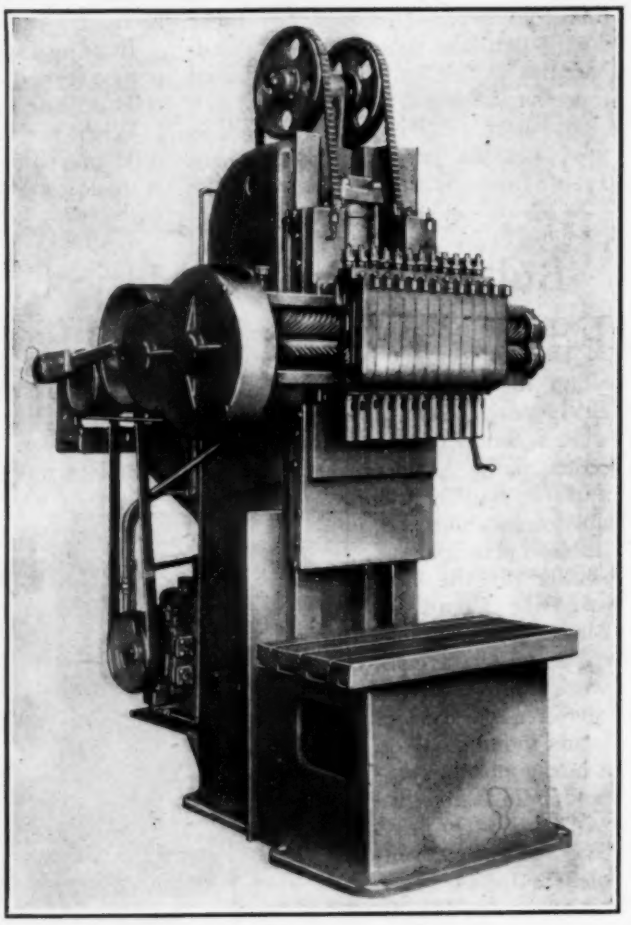


Arrangement of tool heads and centers

Moline "Hole-Hog" No. 115-D Driller

THE Moline Tool Co., Moline, Ill., has added to its line of "Hole-Hog" drillers the No. 115-D machine illustrated. This machine is intended to supersede several types of the old machines, particularly those used in the manufacture of valve parts. The machine consists of a box-section column, extending to the floor, and having guides running the full length. The column has wings to which the base is securely bolted. A U-shaped base is used to prevent interference with the slide. The slide has a narrow guide on the column, and has tapered gibs to permit an easy and positive adjustment. The rail carrying the drive spirals and spindle heads is bolted to the slide, and can be placed at varying heights with respect to the table. The drive is by means of a motor belted to a pulley and an auxiliary shaft. Pick-off gears are provided in the gear case, making quick changes of gears possible. The same motor that drives the machine also drives the Oilgear feed pump, which is of a simplified design intended especially for drilling machines.

The stroke is controlled by a single lever at the right of the machine. The cycle of operation is automatic. The proper setting of the stops will assure an automatic shift of the lever to the slow feed and then into reverse after the work has been completed, stopping at the top of the stroke.



Moline "Hole-Hog" No. 115-D Driller

The machine illustrated has twelve 2-in. heads on the rail, but any BV-type of head or special heads can be applied to give the center distances required. The minimum center distance that can be obtained is 2 in., and the maximum center distance is 40 in. The travel of the rail is 24 in. The floor space required for the machine is 4 ft. 10 in. by 6 ft. A 7½- to 15-hp. motor is required, depending upon the work. The approximate shipping weight of the machine is 10,000 pounds.

American Machinist

EXPOSITION
SECTION

.·.

National Machine Tool Builders' Exposition

CLEVELAND

American Society for Steel Treating Exposition

DETROIT

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In the following pages are contained:

A list of the exhibitors at the first annual Machine Tool Exposition, to be conducted by the National Machine Tool Builders' Association in the West Annex of the Public Auditorium, Cleveland, Ohio, Sept. 19 to 23. There are also listed the products to be shown and the builders' representatives who will attend. Booth numbers are given.

A list of the exhibitors at the ninth annual Steel and Machine Tool Exposition under the auspices of the American Society for Steel Treating, to be held in Convention Hall, Detroit, Mich., Sept. 19 to 23. This list also includes booth numbers and mention of the products to be shown and manufacturers' personnel to be in attendance.

Program of the Machine Tool Congress at Cleveland.

Program of the technical sessions of the Society of Automotive Engineers at Cleveland.

Program of the technical sessions of the American Society for Steel Treating at Detroit.

Program of the technical sessions of the Society of Automotive Engineers at Detroit.

Program of the American Welding Society at Detroit.

Program of the Institute of Metals at Detroit.

Programs of shop inspection and entertainment.

Exhibitors · Products · Representatives

National Machine Tool Builders' Exposition

[Booth Numbers Follow Company Names]

— A —

ABRASIVE MACHINE TOOL CO.—125-A
No. 3 surface grinder, motor driven, with exhaust attachment and magnetic chuck; No. 13 vertical-spindle surface grinder with rotary table, motor driven and equipped with rotary magnetic chuck; No. 5 surface grinder, motor driven, exhaust attachment, magnetic chuck, and generator.
Frank N. MacLeod, pres.; Norman D. MacLeod, v.-p.; C. Gordon MacLeod, treas.; Kenneth B. MacLeod; Harry H. Flint; Water Sceeles.

ACME MACHINERY CO.—619.
Heading machines; bolt cutter.
Messrs. Davies, Bruch, Anderson.

THE ACME MACHINE TOOL CO.—323.
Universal turret lathe.
Charles Meier, Fred. Winkelman; Lee Leon; Howard Myers.

AHLBERG BEARING CO.—A-27.
CJB master ball bearings, single and double row; also self-aligning. Ground bearings. Thrust bearings.
C. J. Bender, pres.; B. S. Okner, engr.; F. W. Meile, sales engr.; R. B. Clark, P. B. Bender, Cleveland; P. F. McGuinn, purch. agent; F. O. Burkholder, sales mgr.

C. G. ALLEN CO.—729.
Drilling machinery.
Harding Allen, H. T. Generess.

American Machinist—117.
Mason Britton, James A. McGraw, Fred. S. Weatherby, Walter McFaddin, W. E. Kennedy, Frank E. Enright, F. H. Johnson, P. B. McGhie, K. H. Condit, F. H. Colvin, L. C. Morrow, F. W. Curtis, Ellsworth Sheldon, W. E. Irish, Arthur Burditt, F. Ormsby Cooke (representing European edition).

THE AMERICAN TOOL WORKS CO.—614.
Lathes, shapers, radials.
J. B. Doan, pres.; J. C. Hussey, H. W. Schatz, F. L. Stube, A. H. Koller.

ANDERSON BROS. MANUFACTURING CO.—A-14.
Power-scraper-electric machine for scraping flat bearings; hand-scraper-hand tool for scraping flat bearings; improved balancing ways for balancing flywheels, pulleys, etc.
Swan F. Anderson, pres.; G. A. Larson, sec'y; G. H. Garrison, rep.

ASSOCIATED MACHINE TOOL DEALER—816.

Automotive Industries.—A-32.
P. M. Heldt; Norman S. Shidle, A. F. Denhan, editors.

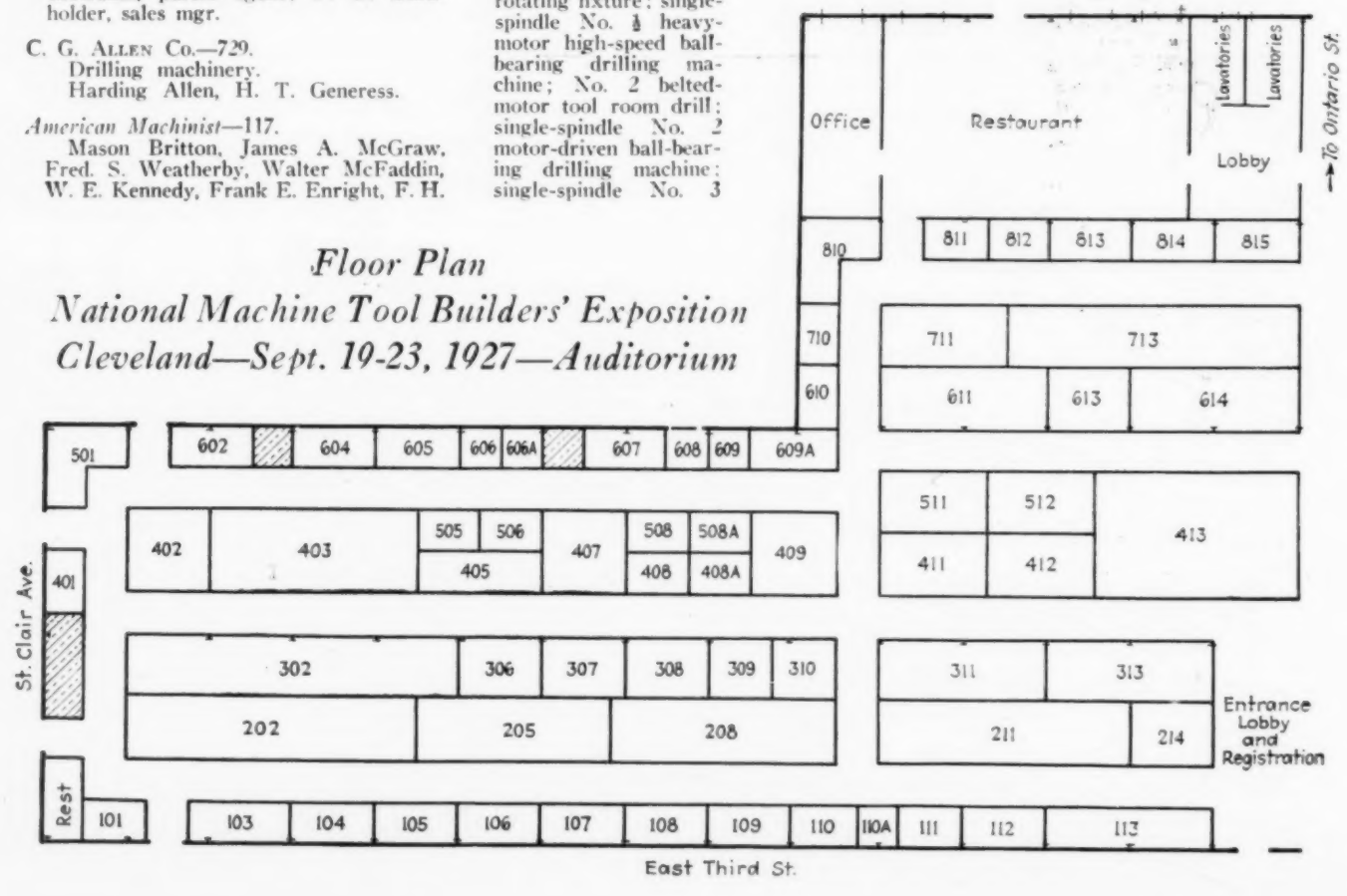
THE AVEY DRILLING MACHINE CO., INC.—228.
Single spindle No. ½ belted-motor high-speed ball-bearing drilling machine with cam feed and automatic rotating fixture; single-spindle No. ½ heavy-motor high-speed ball-bearing drilling machine; No. 2 belted-motor tool room drill; single-spindle No. 2 motor-driven ball-bearing drilling machine; single-spindle No. 3 motor-driven ball-bearing drilling machine with standard motor unit on table; two-spindle No. ½ motor-driven high-speed ball-bearing drilling machine with tapping attachment; two-spindle No. 2 motor-driven drilling machine, one spindle with Aveymatic feed, the other with tapping unit; three-spindle No. 3 motor-driven drilling machine with speed reducer, Aveymatic feed and tapping head; 6-in. Milband cutting saw.
L. B. Patterson, J. G. Hey, J. F. Merriles, D. A. Patterson, F. L. Hazledine, G. M. Galt.

— B —

BADGER TOOL CO.—127.
No. 221 grinder, automatic double spindle type; No. 8 grinder, with hydraulically operated face grinding table; grinding disks; cylinder wheel chucks; accessories.
John Nielsen, v.-p.; E. B. Gardner, pres.; R. D. Gardner, treas.

BAKER BROTHERS, INC.—821.
No. 121 Heavy-duty vertical drilling machine; No. 25 hydraulic boring and drilling machine (single spindle); No. 25

Floor Plan
National Machine Tool Builders' Exposition
Cleveland—Sept. 19-23, 1927—Auditorium



hydraulic boring and drilling machine (5-spindle head and 6-station indexing table); No. 25 hydraulic 4-spindle cylinder-boring machine.

William Baker, H. L. Tigges, G. E. Hallenbeck, W. W. Elliott.

BARBER-COLMAN CO.—313.

Gear hobber; reamer grinder; hobs; reamers.

F. G. Hoffman, sales mgr.; C. M. Cheadle, adv.

BARNES DRILL CO.—221.

Drilling machinery; honing machines.

J. E. Andress, secy.; A. M. Johnson, supt.

W. F. & JOHN BARNES CO.—1027.

Two-spindle diamond boring machine for boring connecting rods; two-spindle diamond boring machine for boring cross holes in pistons; horizontal, duplex drilling machine with Oil-gear feed; No. 300 production drilling with silent chain motor drive.

John S. Barnes, V. A. Root, Fred G. Vosler.

JOHN BATH & CO., INC.—401.

Ground thread taps; ground thread gages; internal micrometers; master reference rings; ground thread rolling dies.

John Bath, pres. and treas.; J. Chester Bath, v.-p.; R. E. Lamb, adv. mgr.; S. W. Bath, eng.

CHARLES H. BESLY & CO.—311.

No. 6 20-in. I wet, motor-driven grinder; No. 49, 53-in. wet grinding machine; No. 161, 30-in. I. grinder; No. 141, 20-in. L grinder; No. 309, 30-in. motor-driven vertical-spindle grinder; Titan abrasive disks; taps.

Edward P. Welles, L. R. Capes, Chas. H. Munch, L. E. Jacobs, C. A. Knill, George Klemp, John F. Curns, William H. Allen, Murdock Campbell, Ralph W. Young, John Miller, Jr., F. G. Lane, Edward Powers.

THE BLANCHARD MACHINE CO.—628.

Automatic surface grinder, No. 16-A; washing attachment; reaming machine.

H. K. Spencer, gen. mgr.; W. B. Blakeman, supt.; H. F. Skillings, H. C. Donovan, F. E. Bartley, W. H. Cannon.

J. G. BLOUNT CO.—609.

Motor-driven grinders; motor-driven buffing machines.

J. G. Blount, Jr., prod. mgr.; F. G. Koppenburg, shop supt.; H. N. Blount, sales mgr.

BOWEN PRODUCTS CORPORATION—606.

Bowen system of lubrication (a centralized system for lubricating machine tools).

W. S. Meeks, H. A. Keith, George W. Severson, W. O. Wright, C. A. Bacon, F. H. Gleason.

THE BRADFORD MACHINE TOOL CO.—622.

"All-geared," universal toolroom lathe with motor drive—with universal relieving, coarse screw cutting, taper turning, draw-in collet, quick-change feeding and threading arrangements, oil pump and pan; unit-type drill heads and tapping heads.

Samuel S. Williams, pres.; Charles J. Smith, secy.; S. C. Watson, sales eng.

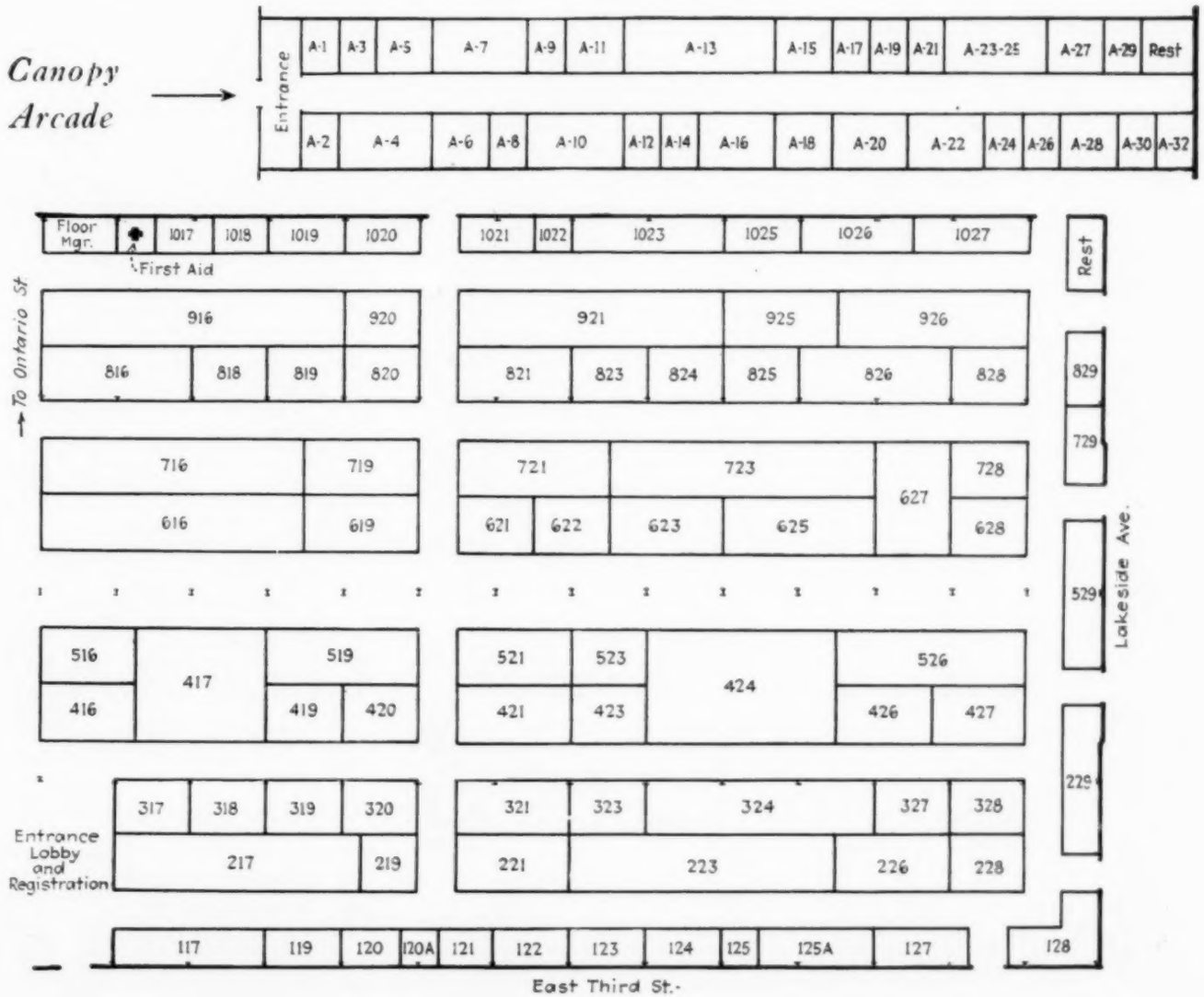
BRIDGEPORT SAFETY EMERY WHEEL CO.—719.

Ninety-six-inch No. 94 heavy-duty face grinder, motor-driven, equipped with 42-in. steel chuck; sectional grinding wheel; No. 186 floor grinder.

H. H. Peck, sec'y.; I. L. Burritt, sales mgr.; F. C. Penny, chf. eng.; H. E. Smith, demonstrator.

BROWN & SHARPE MANUFACTURING CO.—723.

No. 5 heavy, plain milling machine; No. 33 automatic milling machine; No. 21 automatic milling machine; No. OY plain milling machine; No. 34 gear hobbing machine; No. 13 automatic gear cutting machine; No. 13 universal and tool grinding machine with circular forming tool grinding equipment; No. 2 universal grinding machine; No. 2 surface grinding machine with high-speed surface grinding attachment; No. 4 automatic screw machine; No. 2 automatic screw machine, high-speed (for motor drive only), fitted with vertical slide; No. OOG automatic screw threading



machine, high-speed (for motor drive); No. OOG automatic screw machine, high-speed (for motor drive only), fitted with burring attachment; cutters and hobs; machinists' small tools; No. 3 universal milling machine.

J. G. Swinburne, C. A. Ballou; T. M. Conte, J. H. Devlin, J. M. Paterson, R. Rowbottom, J. H. Skelton, W. F. Smith, W. Spencer, E. S. Thurston, J. A. Wagner, J. A. Waterman, J. Yates.

BUCKEYE PORTABLE TOOL CO.—A-9.

Pneumatic screwdriver; pneumatic grinder.

W. W. Price, pres.; W. R. Gummere, H. O. Gummere, spcl. rep.; C. F. Overly, Cleveland; C. Humphrey, Detroit.

BUHR MACHINE TOOL CO.—506.

Multi-head automatic drill press; multiple index fixture (automatic); multiple-spindle drilling and tapping heads; adjustable and fixed center; tap chucks, both friction and positive drive.

Glenn D. Evans, chf. eng.; Wm. H. Nicholls, sales mgr.; Wm. Blades, supt.; Jos. F. Buhr, mgr.

BRYANT CHUCKING GRINDER CO.—920.

Two No. 3 grinders; No. 12, semi-automatic, self-contained internal grinder. Examples showing applications in automotive and other lines of work.

W. L. Bryant, pres.; J. B. Johnson, chf. engr.

BULLARD MACHINE TOOL CO.—417.

Ten-inch six-spindle Contin-U-Matic center lathe; 6-in. four-spindle Mult-Au-Matic; standard vertical turret lathe;

E. P. Bullard, J. W. C. Bullard, E. G. Bullard, E. P. Blanchard, adv. and asst. sales mgr.; J. W. Bray, sales mgr.; John Tillman, chf. sales engr.; W. A. Connor, engr.; F. A. Thompson, engr.; R. H. Newman, engr.; F. E. Hatch, engr.

— C —

Canadian Machinery—105.

B. G. Newton, mgr.; Campbell Bradshaw, ed.; J. H. Moore, special rep.; Viggo Kihl, western rep.

THE CARLTON MACHINE TOOL CO.—823.

Three-foot and 5-ft. heavy-duty radial drilling machine arranged for adjustable speed motor on arm.

Jack C. Carlton.

CHICAGO BELTING CO.—825.

Leather belt running in water; short center drive demonstrating models; operating exhibit of belt shop with actual belt making; mechanical leather specialties.

J. R. Hopkins, service dept.; Floyd Hance, tech, dept.; A. J. Weis, sales mgr.; C. A. Ball, v.-p. of prod.

CHICAGO PIPETHREAD MACHINE CO.—120.

Power pipe and bolt threading machine.

L. H. Taylor, pres.; R. T. Ingalls, sec'y.; Chas. Rasmussen, engr.; W. J. Oberlein, field rep.

THE CINCINNATI BICKFORD TOOL CO.—519.

Three-ft. and 6-ft. Super-Service plain radial drilling machine with constant-speed motor on arm drive; 21-in. Super-Service, cone type, sliding head upright drill with tapping attachment and constant-speed motor drive; 20-in. Super-Service production drill with tapping attachment and constant-speed motor drive.

A. H. Tuechter, G. E. Schauer, L. D. Quackenbush, G. P. Gradolí, R. L. Rickwood, D. C. Klausmeyer, R. M. Husand, N. C. Schauer, S. K. Wallace.

CINCINNATI LATHE & TOOL CO.—111.

16-in. geared head lathe, motor drive, with pan, pump, taper and draw-in attachment. 24-in. heavy-duty, geared head lathe, motor drive.

Wm. C. Heindel, pres.; W. J. Anderson, sales mgr.

THE CINCINNATI MILLING MACHINE CO.—424.

CINCINNATI GRINDERS, INC.—424.

No. 4 vertical miller; No. 1-M plain miller; 48-in. duplex automatic miller; 48-in. plain automatic miller; 12x72-in. plain self-contained grinder; 12x16-in. plunge cut grinder; No. 2 centerless grinder.

F. A. Geier, F. V. Geier, Walter Tangeman, F. B. Heitkamp, C. F. Roby, S. Einstein, R. Harrison, Geo. Binns, P. O. Geier, John Caster, Walter Stegner, F. M. Angevin, L. Nenninger.

THE CINCINNATI SHAPER CO.—317.

24-in. heavy-duty rapid traverse shaper, motor drive; Universal shaper; single and double screw shaper vises; gear burnisher.

P. G. March, Jr., R. T. Hazelton, H. S. Robinson, Geo. Diehl, T. H. Schebrat, Frank T. Goetz.

THE CISCO MACHINE TOOL CO.—1023.

4-ft. radial drill; 18-in. ball-bearing spindle lathe; ¼-in. multi-tap; 5-hp. polishing machine.

H. C. Busch, R. B. Busch, H. P. Kienker, J. G. Schaffner.

CLEVELAND AUTOMATIC MACHINE CO.—523.

Single-and multiple-spindle automatic screw machines; magazine feeds for second operations; special tooling for production work.

H. M. Rich, sec'y; H. W. Rupple, asst. mgr.; R. H. Rich.

THE CLEVELAND PLANER CO.—409.

Open side planer.

E. L. Essley, pres.; E. P. Essley, sec'y.; L. H. Mesker, J. Jenne.

THE CLEVELAND PUNCH & SHEAR WORKS CO.—926.

Double crank power press; inclinable power press; punch press; toggle press; combination punching and shearing machine; small tools, markers, coupling nuts, pistons; punches and dies; rivet sets; chisel blanks.

W. D. Sayle; W. C. Sayle; H. C. Sayle; R. J. Pardee; A. L. Bechtel, H. J. Corrin, R. E. Graves, C. W. Hancock, H. J. Warren, R. S. Howell, W. C. Wright, D. L. Larimer, W. J. Stewart, H. R. Smith, S. Miller.

CLIPPER BELT LACER CO.—A-19.

Belt lacers, fasteners or hooks, cutters with safety feature, connecting pins.

Earl H. Forsyth, factory rep.

COCHRANE-BLY CO.—529.

No. 66 metal sawing machine; No. 11 automatic saw sharpening machine; No. 21 semi-automatic high-speed cut-off saw; No. 14 duplex shaper-miller; No. 1 filing machine; No. 2 filing machine.

W. H. Welch, v.-p.; T. M. Crandall, secy.-treas.; Chester Jacobs, supt.

COLONIAL TOOL CO.—408.

THE COLUMBIA MACHINE TOOL CO.—1018.

16-in. and 36-in. heavy-duty back-geared crank shaper, new design, motor driven.

COMMERCIAL TOOL CO.—501.

Demco sensitive, high-speed drill presses; Grand Rapids universal grinder; adjustable thread snap-gages; plug thread gages; internal micrometers; ground thread taps; air cylinders and chucks; cylindrical plug and ring gages; plain limit snap gages; taper gages, lead and angle testing devices; gage blocks, optical flats; toolmakers' flats; thread measuring wires; dial gages, helical reamers and end mills; ground hobs; milling cutters; gear and cutter testing devices; reamers; broaches, tapping devices; quick-change chucks; amplifying gages; special gages; physical laboratory equipment.

L. K. Goss, pres.; H. E. Henry, v.-p.; W. L. Warrander; John Salzer; L. Borooz, H. I. Findling, Leo Young.

CONSOLIDATED MACHINE TOOL CORPORATION OF AMERICA—713.

Betts-Bridgeford ball-bearing geared-head lathe; Newton milling machine; Colburn heavy-duty boring mill.

A. H. Ingle, pres.; Alfred Trosch, ch. engr.; W. O. Ingle, sec'y. and treas.; R. G. Holmes, H. L. Boecler, F. A. Campbell, A. W. Van Buren and C. R. Williams, sales.

THE CUSHMAN CHUCK CO.—A-26.

Lathe chucks; face plate jaws; boring mill jaws.

H. E. Sloan, v.-p. and wks. mgr.; H. W. Hultgren, genl. sales rep.

— D —

DIAMOND MACHINE CO.—711.

Grinding machinery, surface.

H. S. Chafee, treas.; D. K. Bartlett, v.-p.

THE DRESES MACHINE TOOL CO.—1017.

3-ft. multi-duty, ball-bearing radial drill with constant-speed motor drive on arm.

Charles E. Gilbert, gen. mgr.; J. E. Spaeth, supt.

— E —

THE EASTERN MACHINE SCREW CORPORATION—604.

Die heads, chasers, chaser grinder, threading machine.

C. W. Bettcher, sec'y. and sales mgr.; O. E. Hoelzel, H. F. Wieler, J. E. Jennings, B. DePolo, A. E. Chadwick, G. E. Mager, F. J. O'Rourke, sales and service depts.

EX-CELL-O TOOL & MFG. CO.—609-A.

High-speed internal grinder spindles in motion; standard drill jig bushings.

N. A. Woodworth, pres. and gen. mgr.; Philip Huber, sec'y.; C. R. Alden, sales mgr.; F. D. Sicklesteel, asst. sales mgr.; Wm. F. Wise, prod. engr.; J. R. Haycock, supt. spindle dept.; M. B. Montgomery, supt. bushing dept.

— F —

FAIRBANKS, MORSE & CO.—1019.

Sectionalized squirrel cage and double squirrel cage motors; a new enclosed ventilated motor; a squirrel cage motor; 32-in. shaper in operation with meter to show hp. consumed.

G. T. Aitken, E. Chambers, R. J. Roy, R. L. Johnson, G. J. Podlesax, E. J. Hay, Glen H. Corlette, R. M. Kinney and C. B. Stibolt.

FARRELL FOUNDRY AND MACHINE CO.—512.
Sykes gear-generators cutting straight tooth and continuous tooth herringbone gears; gear tooth comparator.
A. G. Kessler, W. E. Sykes, Austin Kuhns, J. F. Leahy, Paul A. Manger, H. Kitchen, T. Holloway, H. Temporal, John Brandt, D. Watt.

THE FELLOWS GEAR SHAPER CO.—627.
No. 71A-type high-speed gear shaper with scroll type chuck; No. 75-type gear shaper; No. 7-type high-speed gear shaper equipped with side-trimming attachment; No. 7-type high-speed gear shaper equipped with special trimming mechanism which is specially adapted to both the generation of involute and non-involute shapes; No. 6A-type gear-shaper for cutting both internal and external gears; up to 18-in. P.D., 5-in. face; thread generator; gear burnishing machine; the Red Liner, a machine which automatically and graphically records errors in gear magnified 200 times; involute testing machine.
E. R. Fellows, pres. and gen. mgr.; E. J. Fullam, treas.; E. W. Miller, ch. engr.; W. F. Slomer, gen. sales mgr.; E. Stubbs, factory mgr.; Douglas T. Hamilton, adv. mgr.; J. B. Strong, C. A. Bennett, C. J. Nagel, C. C. Bankes.

THE FOOTE-BURT CO.—526.
Multi-cut, vertical broaching machine; single-spindle automatic nut tapping machine; two-way, semi-automatic drilling machine; No. 15-½-F, 6-spindle drilling machine; No. 22-½ high-duty drilling machine; No. 1-¼ Sipp sensitive drilling machine; No. BW-23, 2-spindle Sipp sensitive drilling machine; No. DE-1, single spindle Sipp sensitive drilling machine.
G. E. Randles, pres.; T. H. Dear Jr., v.-p.; W. F. Babcock, Herbert Kennedy, David F. Noble, R. E. Delameter.

THE FOSDICK MACHINE TOOL CO.—319.
6-ft. radial drill, centralized control, head power traverse, pipe tap leads, all gears run in oil, all change gears of sliding type, purolator oil filter; 25-in. heavy-duty upright drill, power feed, quick return, automatic trip and depth gage, sliding head, elevating table, oil pump and piping; 13-in. No. 2 superspeed sensitive drill, two-spindle pedestal type, quick speed change, elevating table, sliding head; ⅜-in. superspeed friction tapper; 16-in. No. 4 sensitive drill, single-spindle pedestal type, power feed, quick return, quick speed change, sliding head, elevating table, oil pump and piping; 16-in. No. 5 sensitive drill, two-spindle pedestal type, power feed, quick speed change, sliding head, elevating table, oil pump and piping; ½-in. friction tapper.
N. B. Chace, W. C. DeRoo, H. L. Fehrman.

FOSTER MACHINE CO.—320.
No. 5 geared-head, Universal turret-lathe No. 3-B Universal turret lathe, with 18-in.-3-jaw; Foster-Barker hydraulic chuck.
W. H. Foster, pres.; H. A. Moore, sales mgr.; Carl Moser, sales.

— G —

THE GAIRING TOOL CO.—505.
Counterbores, core drills, backspot facers and reamers.
E. Gairing, B. O'Meara, J. K. Murdock, G. J. Landry, Wm. G. Harvey, E. T. Gropler, H. P. Boggis, C. B. Cole, J. W. Mull, Jr., D. J. Normoyle.

GALLMEYER & LIVINGSTON.—623.
Grinding machinery.
S. Owen Livingston, v.-p.; B. C. Saunders, secy.

GARDNER MACHINE CO.—420.
No. 89 hydraulic surface-grinder; No. 7½ disk-grinder equipped with mechanically-oscillating work tables.
F. E. Gardner, v.-p.; W. B. Leishman, treas. and sales mgr.; B. H. Pratt, supt. of service; E. M. Risler, Detroit mgr.; H. C. Steinbuck and W. L. Townsend, sales engrs.; H. W. Knopke, sales mgr.

GENERAL ELECTRIC CO.—826.
Electric motors; motor controls.

THE GEOMETRIC TOOL CO.—815.
Self opening dies and collapsing taps including KH standard die heads; KD rotary self-opening die heads; class S collapsing-tap on a Geometric double spindle threading machine.
Jas. W. Sneyd, v.-p.; G. A. Denison, sales mgr.; P. A. Pritchard, J. M. Dillon, Frank Heilman, G. J. Hawkey.

GIDDINGS & LEWIS MACHINE TOOL CO.—321.
No. 45 high-power, precision horizontal boring, drilling and milling machine; No. 11 Teromatic automatic, internal-grinder; No. 9 double-unit Teromatic automatic, internal grinder.
H. B. Kraut, v.-p. and gen. mgr.; C. Gebuhr, sales mgr.; G. A. Pabst, A. E. Ulrich, R. H. McCormick; K. F. Gallimore, chf. engr.; F. J. Glassel, A. E. Hintermeyer, W. J. Porter.

GISHOLT MACHINE CO.—403.
Geared head turret-lathes; automatic chucking-machines; balancing machines; small tools.
A. R. Engler, W. J. Hannum; F. M. Long, E. S. Chapman, L. E. Godfriaux, C. B. Carr, Geo. M. Class, W. I. Senger, W. L. Libby, G. E. Thomas, R. D. Heflin, H. G. Hall, R. E. McCartney, J. H. Nebel, A. W. Sidell, E. J. Conohan, C. J. Baxter, A. E. Lynch, J. S. Wright.

GITS BROS. MANUFACTURING CO.—812.
Lubricating devices.
R. J. Gits; E. C. Beardslee, sales and adv. mgr.; O. T. Morgan.

GLEASON WORKS—208.
60-in. spiral-bevel planing generator; 12-in. two-tool straight-bevel gear generator; 12-in. spiral-bevel cutter-grinder; 8-in. and 10-in. straight bevel gear generator; 18-in. bevel gear test machine; generator tool grinder; spacing tester; standard spiral-bevel gears; spiral-bevel motor reduction unit; hypoid-gear rear axle.
S. H. Earl, wks. mgr.; A. L. Stewart, chf. engr.; F. E. McMullen, chf. engr., gear div.; B. H. Bickle, sales mgr.

GODDARD & GODDARD CO.—306.
Production milling cutters; cutters for railroad work.
C. H. Wallace, sales engr.; H. P. Boggis, Cleveland; E. E. Toerner, Cincinnati; E. E. Guntert, Rochester; Wm. Fritz, mach. oper.

THE GOSS & DELEEUW MACHINE CO.—A-6.
Multiple-spindle chucking-machine single threading, equipped with air chucks; multiple-spindle chucking machine, double threading.
Stanley T. Goss, pres.; S. B. Martin, Cleveland rep.; J. J. Spring, sales engr.; E. H. Peck, demonstrator.

GOULD AND EBERHARDT—328.
32-in. shaper; No. 16HS manufacturing hobbing machine.
F. L. Eberhardt, W. E. Zimmerman, H. W. Jacobson, G. E. Spies, F. G. Eberhardt, J. F. Duffy, J. Allwood, J. Craig.

GREENFIELD TAP AND DIE CORPORATION—423.
No. 28-C Hydroil internal heavy-duty grinder; Universal cutter and reamer grinder, motor driven; snap gages, plain and thread; pipe thread gages; Acorn dies; reamers; plain plug and ring gages; taps; dies; twist drills; pipe tools thread plug and ring gages; screw slotting cutters.
R. B. Hubbell, mgr. mach. tool dept.; Louis Battey, mgr. small tool dept.; E. J. Bryant, mgr. gage and reamer dept.; A. M. Drake, chf. engr.; A. J. Kiehne, sales engr.; G. W. Demarest, railroad dept.; C. H. Miller, demonstrator.

GREENLEE BROTHERS & CO.—521.
Four-spindle 1¼-in. x 6-in. automatic screw machine; operating parts of automatic screw machine; adjustable multiple-spindle hydraulic-feed drilling machine; multiple-spindle drill head.
A. H. Eggers, sales mgr.; J. H. Mansfield, chf. engr.

— H —

HALL PLANETARY CO.—A-11.
Thread millers.
Peter Hall, H. Pies.

HAMMOND MANUFACTURING CO.—A-24.
Radial drilling machines; polishing lathe.
W. D. Buss, W. Osto, H. Blackmore, G. M. Hood.

HANCHETT SWAGE WORKS—A-23.
No. 584 locomotive guide-bar and side surface grinder.
A. K. Hanchett, L. B. Hanchett, and F. K. Benedict of the Hanchett Swage Works, Big Rapids; W. S. Paden, E. C. Filstrup and A. W. Filstrup of the Machinery Co. of America; Geo. D. Miller of William K. Stametz.

THE HANSON-WHITNEY MACHINE CO.—819.
Universal semi-automatic, thread-milling machine; Universal vertical tool and die-shaping machine; Precision centering machine; sharpening machine; taps, gages; hobs; thread rolling dies.
George McPherson, D. J. Normoyle, A. G. Brice, E. H. Huntington, J. W. Johnson, Robert Johnson, C. A. Lauridsen.

HEALD MACHINE CO.—611.
Size-Matic internal grinding machine, No. 72A-3; Duplex size-matic internal grinding machine, No. 72; Rotary surface grinding machine, No. 25A; Magnetic chucks and demagnetizers.
S. T. Massey, asst. gen. mgr.; R. M. Lippard, Cleveland; R. A. St. John, Cleveland; J. G. Wonn and R. W. Frye, Detroit; W. F. Rogers, Syracuse; J. F. Pflum, Cincinnati; M. F. McCormick, Oliver Johnson, Chicago; F. H. Grimshaw.

HENDEY MACHINE CO.—402.
Lathes; milling machines.
C. H. Alvord, pres.; C. G. Bennett, v.-p. and gen. mgr.

HIGLEY MACHINE CO.—A-22.
8-in. swing, carriage type "Coldcut" saw and stock handling tables.
L. M. Waite, gen. mgr.; I. S. Smith, sales mgr.; Henry Smith, supt.

HISEY-WOLF MACHINE CO.—108.
Universal motor electric-drills; bench drilling-stands; double-end electric grinders, floor and bench type; double-end electric buffers, floor and bench type; combination grinder and buffer, floor and bench type; electric tool post grinders; electric external and internal lathe grinders; electric aerial grinder.
E. Ritz, Jr., W. J. Holtmeier, G. J. Hawkey, Cliff J. Henefelt.

THE HOBART MANUFACTURING CO. (CRESCENT WASHING MACHINE DIVISION)—A-28.
Metal-cleaning machines and equipment.
E. C. Arndts, sales engr.

HOEFER MANUFACTURING CO.—1025.
Auxiliary drilling-heads; No. 3 piston driller; 5 hp. high-production driller; No. 3 continuous-driller.
Chester A. Hoefer, secy.; Paul Andree, gen. mgr.

HYATT ROLLER BEARING CO.—610.
Roller bearings.
Harry Carroll, adv. mgr.

THE HYDRAULIC PRESS MANUFACTURING CO.—A-16.
H-P-M Hi-S hydraulic press; H-P-M Hi-P hydraulic radial-pump, variable and reversible delivery type.
Howard F. McMillin, v.-p.; Paul C. Pocock, gen'l. sales mgr.; C. E. Newell, Cleveland dist. mgr.; W. Ernst; H. J. Miller, H. M. Conrad.

— I —

Industry Illustrated—A1.
Harvey Conover, pres.; B. P. Mast, v.-p.; Lloyd Willoughby, Wm. C. Davis.

THE INGERSOLL MILLING MACHINE CO.—413.
Four-head, adjustable rail, heavy pattern, Ingersoll type, milling-machine; four-head, adjustable rail, standard Ingersoll type milling-machine; standard Ingersoll keyway milling-machine; 24-in. Ingersoll face milling cutter-grinder; standard and special milling cutters.
J. M. B. Scheele, J. M. Macrae, F. J. Malone, R. M. Gaylord, E. I. Morgan, W. M. Grove, Percy Ott, H. C. Rose, W. Ingersoll, A. H. Lyon, G. L. Bradley, S. W. Fish, A. A. Braid, W. C. Sproul, J. R. Johnson.

INTERNATIONAL MACHINE TOOL CO.—427.
Libby turret lathes.
O. B. Iles, D. J. Cosner, T. P. Dickinson, H. Heidergott, C. L. Libby, J. Villard, V. V. Caywood, E. H. Stine, G. H. Menzie, F. H. Robertson, A. Ruwe, R. Hunter.

Iron Age—810.
F. J. Frank, pres.; C. S. Bauer, gen. adv. mgr.; F. S. Wayne, western mgr.; Pierce Lewis, Charles Lundberg, Warren C. Sweetser, B. L. Herman, C. H. Ober, W. B. Robinson, D. G. Gardner, D. C. Warren, H. E. Barr, E. Findley, C. E. Lachaussee, H. E. Leonard, Oliver Johnson, B. H. Hayes, A. H. Dix, A. I. Findley, ed.; W. W. Macon, mng. ed.; S. G. Koon, E. F. Cone, C. E. Wright, R. E. Miller, G. L. Lacher, Burnham Finney, F. L. Prentiss, R. A. Fiske, G. F. Tegan, G. S. Herrick, T. H. Gerken, E. E. Thum, assoc. eds.

Iron Trade Review—A-2.
E. L. Shaver, man. ed.

— J —

JONES & LAMSON MACHINE CO.—217.
Fay automatic lathes; J&L flat turret lathe; Hartness screw thread comparator; Hartness automatic dies; Flanders ground thread taps.
H. S. Beal; C. H. Seaver, Cleveland; F. L. Watkins, Detroit; J. L. Reilly, Indianapolis; W. L. Thompson, M. N. White, J. H. Fulkerson, C. F. Childs, reps.

— K —

KEARNEY & TRECKER CORPORATION—205.
Mil-Waukee-Mil Duplex; Mil-Waukee-Mil Simplex equipped with automatic indexing table; No. 2 standard universal milling machine with new light Hi-speed universal milling attachment.
E. J. Kearney, sec'y and treas.; Theodore Trecker, pres.; J. B. Armitage, chf. mech. engr.; Geo. L. Erwin, Jr., sales mgr.; Wm. K. Andrew, chf. prod. service engr.; Geo. E. Gustafson, sales engr., Detroit; Walter P. Lotz, mgr. New York; F. G. Jackson, mgr. Phila.; Carl L. Reasel, mgr. Syracuse; R. A. J. Wellington, mgr. Cleveland; R. W. Ott, mgr. Indianapolis; M. J. Luther, mgr. Chicago; M. J. Schmitt, Milwaukee.

KELLER MECHANICAL ENGINEERING CORPORATION—511.
Type BL-482 automatic tool room machine with jig boring attachment; Type R-6 cutter and radius grinder; Type BK-3 flexible shaft machine with accessories; Type BK-1 flexible shaft machines with high speed attachment and accessories.
J. F. Keller, pres.; S. A. Keller, treas.; Jules Dierckx, v.-p. and sales mgr.; Charles Bitter, G. I. Croll, sales; A. J. Benson, P. D. Brown, Henry Schreiber, P. C. Renno, D. Forrest Butler.

KELLY REAMER CO.—605.
Adjustable boring and reaming tools including single-point, block type, adjustable two-blade and multiple-blade roughing and finishing and special production tools; diamond boring tools.
E. W. Putnam, v.-p. and gen'l. mgr.; A. H. Howard, sales rep.; H. C. Putnam, pres.; M. C. Daw, chf. engr.; F. S. Hartwell, engr.; W. H. Lund, purchasing agt.; H. Berg, supt.

THE KEMPSMITH MANUFACTURING CO.—820.
Plain milling machine.
R. J. Wilson, pres.; J. Goetz, v.-p.; F. Wollaeger, v.-p.; L. Radermaker, chf. engr.; A. Nieman, C. O. Watson, H. L. Livesay, dist. sales mgrs.; H. E. Czerwonky, engr.

THE KENT MACHINE CO.—811.
Semi-automatic six-spindle driller; automatic stud threader; semi-automatic two spindle pointing or chamfering machine.
Arthur S. Day, sales mgr.

THE KING MACHINE TOOL CO.—214.
42-in. heavy-duty new-style vertical boring and turning machine, two heads on cross-rail (right hand fixed turret-left hand swivel head with four way tool holder), and right hand vertical side head with four way tool holder.
E. A. Muller, C. F. Muller, I. Herbst.

KINGSBURY MACHINE CO.—1020.
Automatic drilling and tapping heads and machines.
E. J. Kingsbury, mgr.; Gunner Swahnberg, engr.

W. B. KNIGHT MACHINERY CO.—814.
No. 4 universal vertical miller; high speed attachment; horizontal attachment, shaping attachment, index centers, circular milling table; verniers and scales for jig boring; No. 1½ Knight universal vertical miller.
H. E. Knight, v.-p.; John M. Davis, Cleveland rep.

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LANDIS MACHINE CO.—416.
¾-in. double-head threading machine, 6-in. pipe threading and cutting-off machine; automatic forming and threading machine, all motor driven; Lanco heads for automatic and hand operated threading machines; Land-Matic heads for turret-lathes and hand operated screw machines; Victor collapsible-taps and receding-chaser collapsible-taps.
C. N. Kirkpatrick, sales mgr.; C. F. Meyer, asst. sec'y.; S. W. Mathias, engr.; G. M. Stickell, J. W. Frey, J. E. Hovis, P. A. Reynolds, sales rep.

LANDIS TOOL CO.—226.
Plain hydraulic grinder; self-contained cutter and tool grinder; self-contained Universal grinder; sample of work and parts.
R. F. Ingran, sales mgr.; A. P. Steiner, chf. engr.; J. E. Frantz, pres. and genl. mgr.; H. E. D. Gray, asst. mgr.; S. S. Shoemaker, sales engr.; F. Greiner, R. W. Burk, J. S. Baker, W. G. Nevin, G. M. Talhelm, J. H. Hollinger, H. E. Streeter sales; R. E. Forthman, I. S. Deardoff, J. L. Welsh, special rep.; W. H. Bearinger; J. C. Shindledecker; N. S. Talhelm; R. O. Bearinger.

THE J. N. LAPOINTE CO.—103.
Hydraulic broaching machines; broaching tools; keyway sets.
Edward L. Streeter, Jr., genl. mgr.; Donald H. West, asst. genl. mgr. and engr.; Bant Hanson, sales engr.; Peter Collins; W. T. Bittner.

LA SALLE TOOL CO.—A-29.
No. 1 plain surface-grinder, motor driven; No. 2 La Salle automatic surface-grinder, motor driven; American wet drill-grinder, motor driven.
F. S. Knowles, pres.; J. C. Kopf, chf. engr.

THE R. K. LEBLOND MACHINE TOOL CO.—721.
Heavy-duty automatic crankshaft-lathe with center drive; 16-in. new-model geared-head rapid production lathe; No. 16 heavy-duty, automatic-lathe; No. 12 heavy-duty, multi-cut lathe; universal tool-room grinder; 15-in. geared-head, precision tool-room lathe.
H. C. Pierle, sales mgr.; W. F. Greene, v.-p.; W. O. Strauss, wks. mgr.; R. E. LeBlond, supt.; B. N. Brockman.

THE LEES-BRADNER CO.—324.
Gear grinding machine; gear testing machine; gear hobbing machine; universal gear hobbing machine; thread milling machine; gear finishing machine.
E. J. Lees, pres.; C. H. Schurr, treas.; E. E. Blundell, mgr.; J. G. Stout, special rep.; E. A. Bayton, Detroit rep.; H. C. Young, Chicago rep.; J. Potter Cunningham, New England rep.; F. W. Sebelin, Cleveland rep.; Wm. Hadley, London, England rep.

LEHMANN MACHINE CO.—405.
22-24½-in.x11-ft. bed sixteen speed geared-head engine lathe with taper attachment and rapid traverse to carriage, motor drive with remote control starter.
Paul Lehmann, A. H. Lehmann.

LELAND-GIFFORD CO.—613.
No. 1, 12-in., one-spindle, belted-spindle, bench-type ball-bearing drilling machine; No. 1, 12-in., one-spindle, motor-spindle, bench-type ball-bearing drilling machine with No. 1 ball-bearing tapping attachment; No. 2, 14-in., one-spindle, motor-spindle ball-bearing drilling machine with ball-bearing back-gear unit; No. 2, 14-in., three-spindle, belted-spindle ball-bearing drilling machine with semi-automatic power feed and No. 5 ball-bearing tapping attachment; No. 3, 24-in., one-spindle, motor-spindle ball-bearing drilling machine with semi-automatic power feed and ball bearing back gear unit; No. 3, 24-in., two-spindle, belted-spindle ball-bearing drilling machine with semi-automatic power feed and ball-bearing back gear unit and tapping attachment.
S. B. Dowd, sales mgr.; H. P. Sawtell, A. H. Anderson, C. H. James; J. H. Hoover, E. A. Heidlinger, B. J. Riordan, W. J. Fors.

THE LINCOLN ELECTRIC CO.—307.
Polyphase induction motors; arc welders and examples of welded steel construction.
A. F. Davis, v.-p.; R. P. Tarbell, dist. rep.; R. H. Pennock, O. P. Hanchette, H. P. Egan, sales reps.

LINK-BELT CO.—A-4
Silent chain drives equipped with the bushed-pin joint and the link-belt automatic idler, with illustrations of adaption to main and secondary machine tool drives.
J. S. Watson, gen. mgr. of Dodge works and drive chain dept.; J. S. Holl, adv. mgr.; R. S. Dyson, special engr.; P. V. Wheeler, F. H. Dalrymple; J. D. Walsh, E. H. Smedley.

THE LODGE & SHIPLEY MACHINE TOOL CO.—421.
No. 3, 6-ft. Duomatic lathe; 14-in.x6-ft. selective-head tool-room lathe; 24-in.x10-ft. selective head engine-lathe.
J. Wallace Carrel, v.-p. and gen. mgr.; H. J. Breitenbach, asst. gen. mgr.; Fred. Albrecht, sales mgr.; Fred Schoeffler, supt.; W. L. Dolle, asst. supt.; Robt. T. Johnson, tool supv.

THE LOGANSPORT MACHINE CO.—508.
Air-operated chucks; arbor presses; two and three-jaw collets, air cylinders, drilling and milling devices; automatic, hand and foot control valves; air reducing valves; work ejecting valves, vises.
Frank G. Payson, genl. mgr.; John C. Cotner, supt.

THE LUCAS MACHINE TOOL CO.—621.
Motor-driven No. 42 precision horizontal boring, drilling and milling machine; motor-driven, thirty-ton power forcing-press.
F. P. Sprague, sales rep.; G. A. Yost, sec'y. and treas.; J. B. Green, supt.; J. A. Leighton, sales mgr.; H. M. Lucas, pres.; Oskar Kylin, mech. engr.; O. L. Chapman, sales rep.

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THE MACHINE PRODUCTS CO.—508-A.
Cut gears; splined shafts; clutches; sprockets; worms; worm wheels; gear boxes.
Earl H. Browning, v.-p. sec'y.; Harrison Browning, sales mgr.; Conrad Sandberg, supt.

Machinery—113.
Victor Brook, C. A. Corrigan, E. K. Hammond, H. B. Hurlburt, R. B. Luchars, Erik Oberg, L. Pelletier.

MADISON-KIPP CORPORATION—110-A.
Force-feed; fresh-oil, automatic, centralized machine tool lubricators.
T. E. Coleman, pres.; J. A. Coleman, v.-p.; W. G. Coles, chf. engr.; J. A. Courter, East. sales mgr.; F. R. Clark, sales engr.; A. T. Lillegren, sales mgr.

MCCROSKEY TOOL CORPORATION—813.
Super-adjustable reamers; Wizard quick-change chucks and collets, turret tool-post for engine-lathes; self-centering steadyrests; Nevastop face-plates for engine-lathes.
F. P. Miller, pres.; R. W. Thomas, genl. mgr.; C. M. Sutton, sales mgr.; Frank Walster, supt.; S. P. Miller, treas.; Lewis Skeel, engr.; W. J. Greenleaf, K. B. Spalding, Fred Fisher, A. J. Moore, I. C. Cameron, T. J. Fraser, W. R. Wyatt, Gus Sealander, sales reps.

MICHIGAN TOOL CO.—408.
COLONIAL TOOL CO.—408.
Michigan Tool Co.:—Milling cutters; hobs; gear cutters; metal cutting tools.
Colonial Tool Co.—Plain broaches; spline broaches, gages; automatic broach pullers.
Michigan Tool Co.: Otto Lundell, v.-p. and genl. mgr.; E. H. Kurtz, sales mgr.; T. R. Oleck, H. W. Reynolds.
Colonial Tool Co.: Otto Lundell, pres.; C. J. Halborg, genl. mgr.; E. H. Kurtz, sales mgr.; T. A. Oleck, H. W. Reynolds.

MOLINE TOOL CO.—1021.
No. 10 automatic multiple-spindle lapping machine; No. 115-D hydraulic-feed drilling machine with 12 BV-16 heads; universal joint-head showing driving and driven unit.
Louis Hallene, Russell Brandenburg, Wilson P. Hunt, pres. and mgr.; E. C. Hunt, treas.; C. R. Rosborough, secy.; O. R. Reller, A. E. Lindberg, H. Fink, Willis C. Kuschmann, S. L. Brandenburg, F. Johnson, W. H. Guthrie, D. C. Eipper, F. Johnston, Clarence Hallene.

MONARCH TOOL CO.—625.
14-in. toolroom lathe; 20-and 22-in. lathes, all-helical geared and with ball bearings, double carriage, automatic.
W. E. Whipp, F. C. Dull, J. A. Raterman, P. A. Abe, C. A. Bickel, Robert Bender, Francis Cook, Elmer Reser.

MORTON MANUFACTURING CO.—A-7.
36-in. stroke heavy-duty draw-cut railroad shaper; 36-in. stroke heavy duty draw-cut shaper; finished machine keys and special shapes from cold drawn steel; Robinson automatic air-hose couplings for pipe and hose lines.
Henry E. Morton, pres.; G. F. Goble, mech. engr.; M. Frank Bliss, rep.

MURCHEY MACHINE AND TOOL CO.—710.
Die heads, collapsible taps, threading machinery.
C. K. Chapin, pres.

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NATIONAL ACME CO.—925.
⅞-in., five-spindle automatic screw-machine; 1½-in., four-spindle Gridley automatic screw machine; self-opening dies.
A. E. Drissner, chf. engr.; R. C. Kinley, sales engr.; A. E. Henn, machinery sales mgr.; W. G. Furlong, E. C. Lange, sales reps.; R. B. Miller, Jack Powers, A. P. Williams, demonstrators.

NATIONAL AUTOMATIC TOOL CO.—412.
Natco model C-13 multiple-spindle lead screw tapper; C-13-H hydraulic feed driller; No. 9 single-spindle Hi-duty driller; S-4-H duplex driller; C-110 horizontal hand feed duplex driller; universal joints; tap and drill holders.
W. H. Holmes and H. A. Fuller.

THE NATIONAL MACHINERY CO.—109.
H. E. Lott, C. D. Harmon, W. H. Kildow, Jr.

NEW BRITAIN MACHINE CO.—229.
No. 23A, four-spindle, air-controlled automatic chucking-machine (tool rotating); No. 454, four-spindle new-matic chucking-machine (work rotating); No. 172, 1-in.x5-in., six-spindle automatic screw-machine.
H. H. Pease, pres.; Edw. L. Steinle, mach. sales mgr.; G. K. Atkinson, Cleveland rep.; James W. Barr, Chicago rep.; L. E. Jolls, J. J. Ritter, T. C. Stirling, Detroit reps.; F. Rau, J. J. Barry, Chicago; S. Meyerjack, Eastern; C. A. Perry, Ohio demonstrator.

NEW DEPARTURE MANUFACTURING CO.—A-8.
Bearings.
DeWitt Page, pres.; F. G. Hughes, v.p.; L. G. Sigourney, sec'y.; W. E. Wightman, treas.

NIAGARA MACHINE & TOOL WORKS—419.
No. 68-B, double-crank power press, single-geared frame of 4 piece tie rod construction; No. 7-A, inclinable power press plain flywheel type, with single stroke attachment for clutch; No. 696, power, gap squaring-shear.
Russell J. Caplin, sales engr.

NILES TOOL WORKS.—716.
Boring machines; radial drills.
A. C. Pletz; H. K. Smyth, sales engrs.

NORMA HOFFMAN BEARINGS CORPORATION.—128.
Precision ball, roller, and thrust bearings; Norma minimeter; several models showing successful application of bearings in machine tools.
O. P. Wilson, v.-p.; D. E. Batesole, asst. eng. mgr.; R. E. Hecker, C. D. Kilham, Cleveland reps.; Geo. R. Bott, engrg. mgr.; Norman Bell, asst. sales mgr.; T. J. Harley, T. M. Kaino, Chicago reps.

NORTON COMPANY—GRINDING MACHINE DIVISION—202.
14-in.x24-in. heavy duty BA grinding machines; type B full-automatic; type B semi-automatic; 10-in.x50-in. type A semi-automatic cam-grinder; No. 2 motor-driven Universal tool and cutter grinder; 36-in. type S, high-speed snagging stand; grinding wheels, refractories and floors.
W. L. C. Neilson, v.-p. and gen. sales mgr.; H. W. Dunbar, asst. gen. sales mgr.; J. C. Spence, wks. mgr.; C. H. Norton, cons. engr.; A. G. Beldon, chf. engr.; W. T. Montague, sales mgr.; H. J. Griffing, asst. sales mgr. grinding mach. div.; H. P. Chaco, sales engr. grinding mach. div.; O. E. Nordstrom, C. H. Hill, H. L. Swainey, Chicago; O. A. Knight, J. O. Hedlund, G. B. Taft, N. H. Hubbard, Detroit; John Cook, Syracuse; M. E. Mattson, E. W. Hellstrom, A. R. Sandine, Cleveland office.

— O —

OAKITE PRODUCTS, INC.—A-20.
Educational exhibit on Oakite materials and methods; temporary rust preventions; cleaning metal parts during

process of manufacture; grinding; cutting; stamping and drawing operations.

Carl Johnson, tech. dir.; F. A. Aston, Detroit dist. mgr.; W. H. Cook, asso. ed.; P. A. Pinsoneautt, rep., Cleveland; H. C. Duggan, Toledo.

OESTERLEIN MACHINE CO.—516.

Tilted offset miller, 48-in.; Ohio tilted rotor, 40-in.; No. 2 Ohio milling machine; No. 2 motor-driven grinder; 24-in. Aurora upright-drill.

Charles D. Oesterlein, Charles Freudenthaler, A. H. Merschel, C. R. Kline, Otto Michael.

THE OHIO MACHINE TOOL CO.—310.

24-in. Ohio dreadnaught shaper.

Charles C. Swift, John Seibold, Karl Sherman, S. K. Johns, C. J. Davis.

THE OILGEAR CO.—308.

No. 3 hydraulic broaching-machine; twin-ten hydraulic broaching machine; 7½-hp. variable speed rotary transmission.

E. C. Wollaeger, Lester Kissel, sales engrs.

OLIVER INSTRUMENT CO.—121.

No. 51 chuck-head drill pointer; drill point thinning machine; type SP-2 die making machine; Arc face mill grinder.

E. C. Oliver, R. J. Sack.

OSTER MACHINERY CO.—A-17.

Threading machinery.

A. S. Gould.

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PEERLESS MACHINE CO.—408-A.

6-in. metal sawing machine; 6-in. sawing machine with motor; 9-in. sawing machine with motor.

A. H. Goetz, sales mgr.; C. A. Schuman, asst. mgr.; Charles Rasmussen, chf. engr.

THE PORTER-CABLE MACHINE CO.—829.

Hi-speed production-lathe; belt grinder; disc sander and grinder; Universal attachment for milling machines; portable sander; kwicksaw.

W. A. Ridings, pres.; A. N. Emmons, chf. engr.; W. C. MacBain, supt.; Ward Gere, sales engr.; D. J. Ridings, sales mgr.

PRATT & WHITNEY CO.—616.

13-, 16-, and 20-in. model B lathes; jig borer; 6-in. vertical shaper; bench lathe; No. 3 bench miller; automatic lathe; small lathe; small tools; milling cutters, taps, dies, etc. and gages.

C. R. Burt, v.-p. and gen. mgr.; W. P. Kirk, gen. sales mgr.; F. O. Hoagland, m. m.; W. H. Miller, sales mgr.; C. M. Pond, mgr. small tool dept.; A. H. d'Arcambal, sales mgr. S. T. dept.; David Ayr, factory mgr.; H. D. Tanner; E. C. Shultz, adv. mgr.

PUTNAM MACHINE CO.—916.

5-in. horizontal boring, drilling and milling machine of the table type; 36x36-in.x12-ft. double housing planer, reversing motor drive.

F. J. Baumis, v.-p.; C. A. Moore, Jr., pres.; E. M. Moore, v.-p.; J. Wainwright, sales mgr.; A. C. Gough, chf. drft.; E. L. Fickett, engr.; P. E. Arthur, supt.; W. O. Forman, wks. mgr.; C. A. Sayward, W. A. Deems, T. S. Stephens, O. L. Andrews and F. M. Maley, sales.

— R —

RACINE TOOL & MACHINE CO.—112.

Shear-cut production saws; gravity-feed and positive-feed reciprocating saws; duplex band-saws for soft and hard metals; abrasive metal cutters for hardened tool steels.

M. E. Erskine, pres.; J. M. Jones, v.-p.; E. R. Larson, dist. sales mgr.; P. F. Schatzman, rep.

RAMSEY CHAIN CO.—A-15.

Driving chains.

A. N. B. Farrell, pres.; F. D. Parker, adv. mgr.; M. Ramsey.

RANSOM MANUFACTURING CO.—818.

Heavy electric-driven snagging grinding machines—No. 6, 14-in. safety flanges; wheel dresser.

George P. Ranson, pres.; Frank W. Walsh, sales mgr.; Roy L. Burdick,, Homer P. Ransom, special reps.

REED-PRENTICE CORPORATION.—828.

New 14-in. sliding gear head lathe; die-sinking and vertical milling machine; No. 2 Becker high-speed ball-bearing router and vertical miller; No. 1 Wolf portable link sawing machine.

F. W. McIntyre, v.-p. and sales mgr.; R. C. Blackinton, chf. engr.; A. W. Schneider, wks. mgr.

RICKERT-SCHAFER CO.—106.

Die heads; collapsible taps; tapping machines; chaser grinders; boring heads.

Geo. Shafer, pres.; A. A. Rickert, treas.; A. A. Shafer, gen'l. mgr.; C. W. Howard, sales mgr.; J. W. Shea, service mgr.

ROCKFORD DRILLING MACHINE CO.—602.

Drilling and boring machines; turning machine; spring testing machine; clutches.

E. C. Traner, secy.; W. W. Blomberg, chf. engr.; J. J. Morris, wks. mgr.

ROCKFORD MACHINE TOOL CO.—119.

36-in. Universal openside shaper-planer; 24-in. Hy-Service shaper.

Morris Monson, genl. supt.

JOSEPH T. RYERSON & SON, INC.—302.

30-in.x16-ft. geared head engine lathe; disc-type sensitive drill; No. 10 horizontal drilling machine; Nos. 0, 1 and 5 serpentine, throatless-shears; combination punch and shear; No. 4 punch; Nos. 0 and 4 high-speed friction saws; No. 1 nail machine.

A. G. Bryant, mgr.; C. R. Gregg, asst. sales mgr.; A. P. Schumann, mach. tool divi.; I. B. Yates, chf. engr.; V. N. Towers, chf. designer; R. S. Armstrong, T. W. Delanty, F. J. Clark, R. C. Page, D. MacArthur, F. G. Grosse, G. H. Merriell, E. S. Pike, Chicago; M. C. Fidgeon, R. H. Happersett, New York; F. E. Hesse, Boston; E. A. Lynch, O. A. Bloomquist, J. M. Eckes, Pittsburgh; H. C. Kelsey, Buffalo; M. H. Dixon, Cleveland; A. L. G. Gentles, Cincinnati; E. L. Critchlow, B. A. Barnett, T. J. Bold, G. A. Francoeur, Detroit; R. A. Davidson, E. N. Carlson, St. Louis; D. S. Mair, Houston; C. J. Harter, Dallas; P. H. Peterson, export dept.

— S —

SKF INDUSTRIES.—824.

Bearings.

Wm. Batt, pres.; R. F. Runge, v.p.; R. H. DeMott, gen'l. mgr.; W. Jetter, sales engr.

THE SAFETY EMERY WHEEL CO.—A-10.

Motor-driven ball-bearing bench and floor grinder; motor-driven, ball-bearing floor grinder; heavy ball-bearing floor stand; swing type portable ball-bearing grinder, and grinding wheels in plain, safety and special shapes; safety collars.

Charles W. Gwyn, v.-p. and secy; H. G. Weinland, M.E.; H. G. Bennett, W. H. Vance, sales.

WM. SELLERS & CO.—211.

No. 1 tool grinder; No. 2 tool grinder; drill pointer; No. 2A drill grinder; 36-in. planer.

G. H. Benson, J. C. Hinton, E. L. Holljes, J. D. McClintock, A. Sellers, Jr.

THE SIDNEY MACHINE TOOL CO.—107.

18-in.x10-ft. and 16-in.x8-ft. Monotrol geared-head lathe.

A. C. Getz, genl. mgr.; B. A. Getz, sales mgr.; H. A. Davies, W. A. McClure, sales dept.; M. K. Miller, prod. fore.; E. A. Hawver, demonstrator.

THE SKINNER CHUCK COMPANY.—606-A.

Air-operated 2 and 3 jaw chucks of adjustable and non-adjustable types; heavy-duty chucks of independent and universal scroll type.

K. H. Walther, engr.

SLOAN & CHACE, INC.—A-21.

No. 6 bench-lathe, motor-driven; No. 5½ bench-lathe; bench milling machine; magazine-feed pinion cutter; 3½-in. gear cutter; radius turning tool; tapping machine; drill presses.

Wm. F. Smith, pres.; G. H. Anderson, sales rep.; M. P. Kernahan, mgr.

THE SMITH & MILLS CO.—110.

25-in. back-geared crank shaper, gear box type, arranged for constant speed motor drive.

J. E. Mills, C. G. Brockman, P. W. Yowler.

THE SPRINGFIELD MACHINE TOOL CO.—120-A.

14-in.x6-ft. engine lathe.

P. E. Montanus, pres.; Paul A. Montanus, v.-p. and genl. mgr.; Edw. S. Montanus, sec'y.

STANDARD STEEL SPECIALTY CO.—A-18.

Machine keys; machine rack; taper pins; Woodruff keys; special milled sections; elevator guides.

E. J. Wagner, pres.; J. B. Jamison, sec'y. and sales mgr.; J. A. Espy, supt.; R. E. Wagner, prod. mgr.

THE STANDARD TOOL COMPANY.—607.

High-speed twist drills; carbon and high-speed reamers; carbon and high-speed taps with ground threads.

H. C. McKean, genl. mgr.; W. P. Ross, sales mgr.; R. R. Higgins, asst.; H. R. Hanson, sales; Herman Will, supt; T. D. Bascom, mech. engr.; C. C. Buck, metallurgist; J. G. McGuire, serv.

STOCKBRIDGE MACHINE CO.—A-3.

Leon J. Barrett, Hubert G. Kilbourne, cons. engr.; Ralph Simpson, sales mgr.; Everett L. Edmunds, wks. mgr.

SUNDSTRAND MACHINE TOOL CO.—411.

No. 5 Rigidmil with one opposed head and one vertical head; No. 3 standard Rigidmil; 15-in. automatic production lathe.

Charles B. DeVlieg, wks. mgr.; D. B. Burleigh, sales mgr.; T. B. Buell, East. rep.; L. A. Dumser, West. rep.; W. G. Nichol, Geo. W. Brunton, sales engrs.; H. L. Olson, genl. mgr.; G. D. Sundstrand, v.-p.; E. J. Swenson, designer.

SUN OIL CO.—A-5.

Cutting oils; motor oils; lubricating oils; rust proofing oils; emulsifying cutting oil; tempering and quenching oils.

Charles K. Hague, D. G. Proudfoot, G. B. Harding, Ed. Morrison.

SWIFT ELECTRIC WELDING CO.—309.

Welding machinery and equipment.

C. C. Swift, pres.; R. G. English.

— T —

THE TAYLOR & FENN CO.—318.
Spline milling machine; vertical milling machine; ball-bearing drilling machine; power operated spring press; No. 0 spring foot press; No. 00 spring foot press.
Geo. S. DeLany.

THE THOMPSON GRINDER CO.—1022.
Self-contained 10x36-in. universal grinding machine.
C. Baldenhofer, W. G. Baldenhofer, H. J. Warrick.

THE TIMKEN ROLLER BEARING CO.—122.
Roller bearings as used in machine tools.
L. M. Klinedinst, B. E. Keifer, R. W. Ballentine, W. B. Moore, A. G. Norris, J. W. Weir, R. P. Kelley, M. H. Kuhl, S. M. Weckstein, G. D. Thewlis, T. V. Buckwalter.

TORRINGTON CO.—101.
Swaging machinery.
J. H. Blackford, sales mgr.; W. J. St. Onge, adv. mgr.

TUTHILL PUMP CO.—A-12.
Plain coolant pumps; reversing coolant pumps; lubricating system pumps; general service pumps, high pressure multistage; gear pumps.
H. E. Kempton, O. L. Bock, J. B. Lacey, G. B. Tuthill.

— U —

UNION MANUFACTURING CO.—123.
Work holding chucks.
A. F. Corbin, pres.; H. H. Wheeler, treas.; C. S. Neumann, sec'y.

UNION TWIST DRILL CO.—124.
Twist drills; reamers; milling cutters; hobs.
W. B. McSkimmon, pres.; Henry Drury, sec'y.; J. H. Drury, treas.

THE UNITED STATES ELECTRICAL TOOL CO.—A-13.
Portable electric drills; portable electric tappers; electric center and parallel grinders; bench and floor tool grinders.
G. E. Smith, treas.; G. M. Lawrence, sales mgr.; R. J. Cook, engr.; Laurence Thompson, W. J. McFarland, dist. mgrs.; R. H. Glore, demonstrator.

UNIVERSAL BORING MACH. CO.—219.
Heavy duty No. 24 Triway horizontal boring machine with vernier attachments and built in crane.
Leon F. Marsh, mech. engr.; Warren B. Robbins, service rep.; W. H. Chapman, Detroit rep.

— V —

THE VAN DORN & DUTTON CO.—426.
Lucas horizontal boring mill No. 43 transmission; gear display.
F. W. Sinram, pres.; F. G. J. Awig, chf. engr.; L. G. Hewins, sales mgr.; J. E. Stover, asst. sales mgr.; J. C. Miller, sales.

THE VAN DORN ELECTRIC TOOL CO.—426.
Portable electric drills; portable electric grinders; portable electric screw drivers; portable electric tappers; portable electric nut setters; electric motor valve refacers.
F. H. Zulauf, gen. sales mgr.; O. C. Kiehne, asst.; F. R. Duguay, dist. sales mgr.; E. L. Connell, chf. engr.

VAN NORMAN MACHINE TOOL CO.—728.
Nos. 23 and 42 internal radius oscillating grinder; No. 3 external radius oscillating grinder; Nos. 10 and 20 duplex millers.
C. E. Van Norman, pres.-gen. mgr.; J. Y. Scott, asst.; F. D. Van Norman, v.-p. and sales mgr.; G. H. Whiting, Detroit; W. Edes, sales engr.

— W —

WALCOTT MACHINE CO.—921.
Melling contour lathe; crankpin and cheek facing lathe; cam lathe; line-bearing lathe; gear grinder.
D. G. Kimball, pres.; N. R. Townley, v.p.; R. G. Williams, E. W. Ilett, sales rep.; C. H. Sylvester, engr.; W. D. Hunt, engr.; J. D. Forrer, fact. mgr.; L. Suhr; J. P. Bush, C. Curui, reps.

O. S. WALKER CO.—125.
Magnetic chucks of different types.
C. O. Smith, treas.

WARNER & SWASEY CO.—223.
Nos. 1-A, 3-A, 4-A universal turret lathes; No. 4 all geared head turret lathe.
P. E. Bliss, v.p.; A. C. Cook, v.p.; C. J. Stilwell, sales mgr.; dist mgrs.: F. J. Pelich, Milwaukee; W. K. Bailey, Cleveland, C. S. Stilwell, Detroit; E. R. Gardner, New York; G. Kochenderfer, Chicago; W. L. Loegler, Dayton; A. H. Keetch, Buffalo; L. K. Berry, Philadelphia; R. L. Glaser, Boston.

WESTINGHOUSE ELECTRIC & MANUFACTURING CO.—327.
Motors for machine tool application, including a.-c. and d.-c. motors and control; high frequency motors for high speed tools; motor parts for built-in motor drive; new design push button starters; induction frequency changer and micarta gears.
F. E. Foisey, D. H. Byerly, G. H. Haynes, B. Lester, W. W. Reddie, E. H. Ott, R. P. Fairgrieve, H. B. Black, R. T. Cloyes, L. W. Hillshaffer, F. W. Sinran, A. H. Ahwig, L. G. Hewins, T. E. Laighton, O. N. Stone, A. M. Jones, H. F. Barton, B. L. Clegg, R. L. Attig, J. A. Franklin, Mr. Johnson, Mark Dawson, J. M. Ireland.

WICACO SCREW & MACHINE WORKS, INC.—A-30.
Continuous oil groover; screw machine products.
Charles W. Lawser, pres.; Allison Sharp, treas.; Wm. F. Hennesey, wks. mgr.

J. H. WILLIAMS & CO.—104.
Tool holder; clamps; lathe dogs; snap gages; crank and balance handles; screw wrenches; drop-forged wrenches; special drop-forgings.
A. S. Maxwell, gen. sales mgr. stock products; J. C. Scanlon, gen. sales mgr. special forgings; A. F. Carew; H. Nelson; A. E. Schierbaum, H. Wisbauer.

WILLIAMS WHITE & CO.—407.
Osterholm surface grinders; Bates pneumatic hammer; eye bender; vertical bulldozer; spacing table model.
H. Ainsworth, W. L. Eiteman, C. W. Fiske, H. C. Hoover, G. P. Kline, J. E. Maynard, W. C. Osterholm, H. H. Rogers, Frank Ryman.

WILMARTH & NORMAN CO.—1026.
No. 78 motor drive super surface grinder; No. 3 wet surface grinder, belt drive; No. 1 surface grinder, belt drive; No. 1 universal cutter and tool grinder, power feed; No. 99 cutter and tool grinder, belt drive; style "JB" point improved drill grinder.
Charles H. Slaughter, gen. sales mgr. and Arthur Williams, gen. supt.

WISCONSIN ELECTRIC CO.—608.
High-speed grinding machinery.

Exhibitors · Products · Representatives

American Society for Steel Treating Exposition

[Booth Numbers Follow Company Names]

— A —

ABRASIVE CO.—375.
Grinding wheels of Borolon and Electrolon in various sizes, shapes, grades, etc.; Borolon polishing grain; Electrolon polishing grain.
W. A. MacFarland, dist. sales mgr.; I. R. Blair, main office; A. J. Lewis, W. A. McMillan, Detroit reps.

ACME ELECTRIC WELDER CO.—151A.
Electric spot welding machines; samples of welded products; butt welder.
W. L. B. Cushing, factory rep.; A. V. B. Cutler, dist. sales mgr.; George M. Hessdoerfer, sales rep.

ACME STAMP CO.—353.
Marking dies and devices; marking machines hand and power operated.
W. F. Forrester, Emory Hendrickson, V. E. Sorge, Don E. Forrester.

AIR REDUCTION SALES CO.—145 & 166.
Airco oxygen and acetylene in cylinders. Davis-Bournonville welding and cutting torches, regulators, apparatus and supplies.
C. M. Bloodgood, mgr. Detroit dist.; J. M. Bowers, J. E. Rogers, H. L. Rogers, J. L. King, B. C. Rogers, E. Van Alstyne.

AJAX MANUFACTURING CO.—221.
New model 1½-in. twin-geared upsetting forging machine. This machine is fitted for demonstrating upsetting, flattening, punching, swaging and bending. An electrical heating furnace is furnished by the American Car & Foundry Co.
Gordon G. Fristoe, Cleveland; W. W. Criley, Cleveland; A. L. Guilford, Chicago.

ALLEGHENY STEEL CO.—473.
Miscellaneous products of Ascoloy, an alloy that resists corrosion, heat and abrasion.
C. B. Callomon, mgr. of alloy sales; O. M. Otte, eng.; H. N. Arbuthnot, mgr. Detroit office; Ray L. Perso, eng.

ALLIS-CHALMERS MANUFACTURING CO.—338.
Roller bearing motor of the enclosed self ventilating type; Texrope driven centrifugal pumping unit.
A. K. Birch.

AMERICAN BRASS CO.—146.
A complete line of Anaconda copper alloy welding rods developed to meet the demand for rods which flow freely at a relatively low temperature and make strong, tough, satisfactory bonds. Welding demonstrations.
A. M. Dinkler, W. C. Swift, W. H. Dowd, Waterbury; M. B. Allen, Detroit; H. G. Wallis, Kenosha, Wis.

AMERICAN CAR AND FOUNDRY CO.—156.
No. 3, 3-electrode Berwick electric rivet heater for rivets ⅝ to 1¼-in. in diameter and of any length up to 7¾-in. No. 3, 1-electrode Berwick heater for heating ends of rods, or on given portions along the length of the rod.
F. C. Cheston and Harold C. Cheston, sales agts.

AMERICAN ELECTRIC FUSION CORPORATION.—176.
Automatic spot welder with capacity of two pieces of ¼-in. stock. Actual throat depth of 9½-in. Production duty type welder, welding capacity two pieces ¼-in. stock; portable spot welder, capacity two pieces 7/16-in. stock.
Edmund J. Henke, pres.; G. A. Fuhrmark, dir. of sales; B. Scherndahl, sales dept.

AMERICAN GAS ASSOCIATION.—Woodward Annex.
Gas fired heat-treating furnaces. Practically all types of combustion systems are included. There is also a

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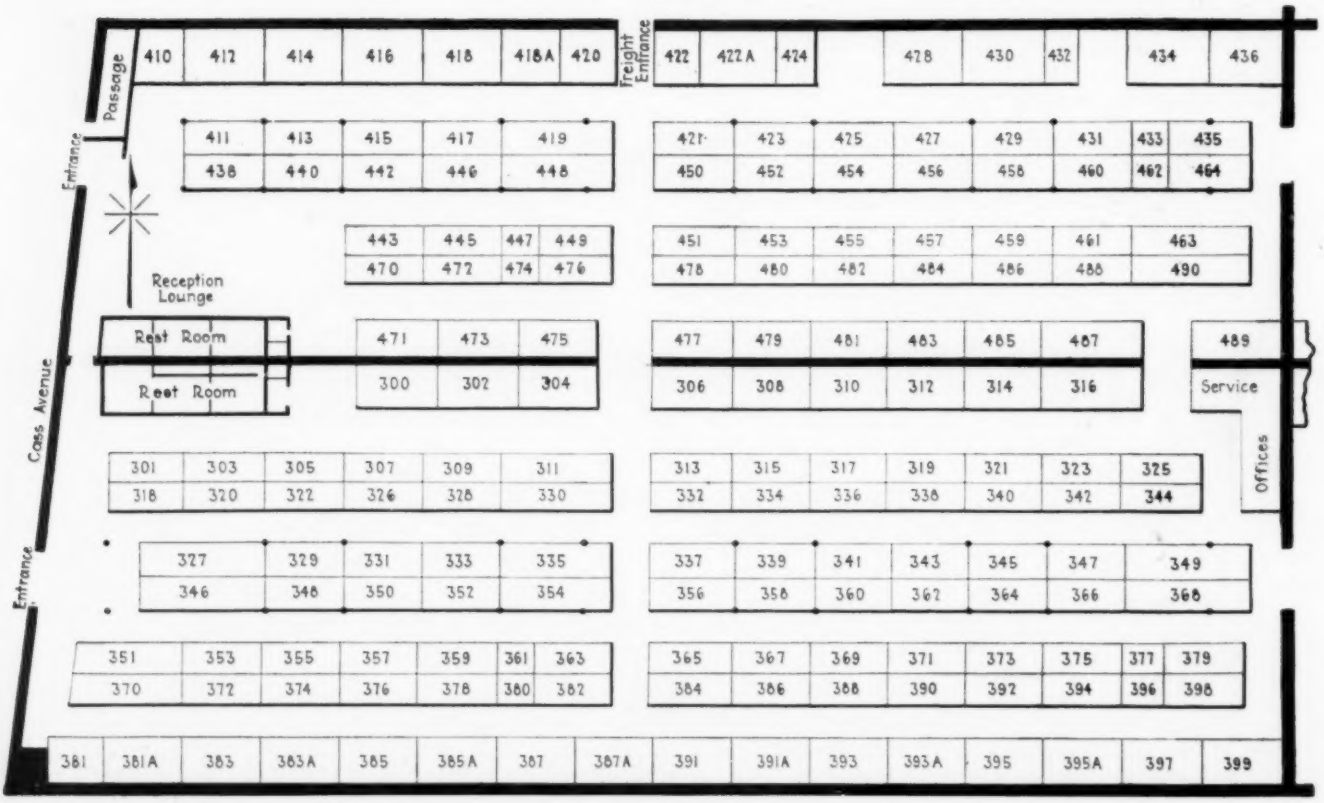


completely outfitted metallurgical laboratory shown.

The American Gas Association Committee on Display at Industrial Exhibits, consists of D. W. Chapman, chairman; R. G. Guthrie, H. A. Clark, A. M. Apman, members. Also J. S. Comstock, F. H. Andrews and H. F. Rehfeldt.

AMERICAN GAS FURNACE CO.—North Woodward Annex.

Rotary retort and a vertical retort cylinderical furnace for the surface hardening of steel by the new Nitrogenizing process; oven furnaces; forges; carbonizing machines; continuous rotary retort heating machines; roller conveyor machine; reciprocating hearth machine, with suitable quenching tanks; rotary brass melter; gas booster; heat controller; also a wide variety of burners and blowpipes and a small melting furnace, etc.

P. C. Osterman, v.-p. and ch. eng.; John Mehrman, special rep.; Gustav Schwab, development engr.; T. Farwick, Sr., automatic heat controller and burner expert; Elmer C. Cook, engr.; S. C. Dinsmore, Detroit rep.; William J. Barenscheer, Chicago, rep.

AMERICAN HOIST AND DERRICK CO.—162.

Two-jaw electric heater, portable type; four-jaw electric rivet heater.

W. K. Garvin and P. J. Kiwus.

AMERICAN LANOLIN CORPORATION—421.

Mainly small pieces of steel in both bright and pickeled finish protected with water soluble rust-proofing compound, Paralan and Rustop.

James Baillie, tech. dir.; J. B. Pollard, dist. mgr.; L. L. Roquet and J. O. Nesser, dist. rep.

American Machinist.—227.

Mason Britton, James A. McGraw, Fred S. Weatherby, Walter S. McFaddin, P. B. McGhie, F. H. Johnson, Frank E. Enright, W. E. Kennedy, W. E. Irish, K. H. Condit, F. H. Colvin, L. C. Morrow, E. Sheldon, F. W. Curtis, F. Ormsby Cooke (representing European Edition of *American Machinist*).

American Metal Market.—457.

Rudolph A. Langer, adv. mgr.

AMERICAN METALLURGICAL CORPORATION.—139.

American electric pot furnaces 7.5 to 30 kilowatt for pots from 6 x 10-in. to 24 x 12 x 17-in.

K. A. Juthe, pres.; S. N. Juthe, v. p.; H. A. Hanson, ch. eng.; J. C. Juthe, sales mgr.; W. H. Ogden, E. E. Bolds, G. F. McGill, rep.

AMERICAN RESISTOR CORPORATION.—137.

Globar element equipped furnace, operating at forging temperature; other appliances with Globar elements.

Joseph A. Steinmetz, pres.; W. E. Duersten, v.-p.; B. G. Tarkington, mgr. industrial sales; Oscar Brophy, S. Perkins, sales engrs.; Arnold Pfau, Jr., ch. of development dept.

AMERICAN SPRING AND MANUFACTURING CORPORATION.—302.

Extension and compression springs; torsion springs; flat springs and wire forms; metal stampings; special exhibit of springs used in the automotive industry.

E. A. Hartz, gen. mgr.; J. A. Cox; E. E. Hartz, factory reps.

AMERICAN STAINLESS STEEL CO.—421.

Manufactured articles representing some of the industrial and engineering applications of stainless steel.

J. C. C. Holding, mgr.; C. S. Bunting, sec'y and treas.

AMERICAN STEEL AND WIRE CO.—174.

AMES CO., B. C.—388.

Precision bench lathe with cabinet and gear drive; triplex combination lathe; miller, and drille press; bench milling machine with overarm support; micrometer dial gages.

Warren Ames, pres.; Russell M. Coldwell, engr.

AMPCO TWIST DRILL CO.—266.

High-speed drills and reamers; Mellings mill, drill-matics; and automatic machinery.

L. C. Bloomfield, pres.; Ben Jones, secy. and treas.; F. J. Sikorovsky, factory mgr.; Geo. Melling, dir. of machinery sales; C. T. Goodwill, sales mgr., tools; Don Noble, sales rep.; Geo. Mitchell, David O'Brien, service engrs.

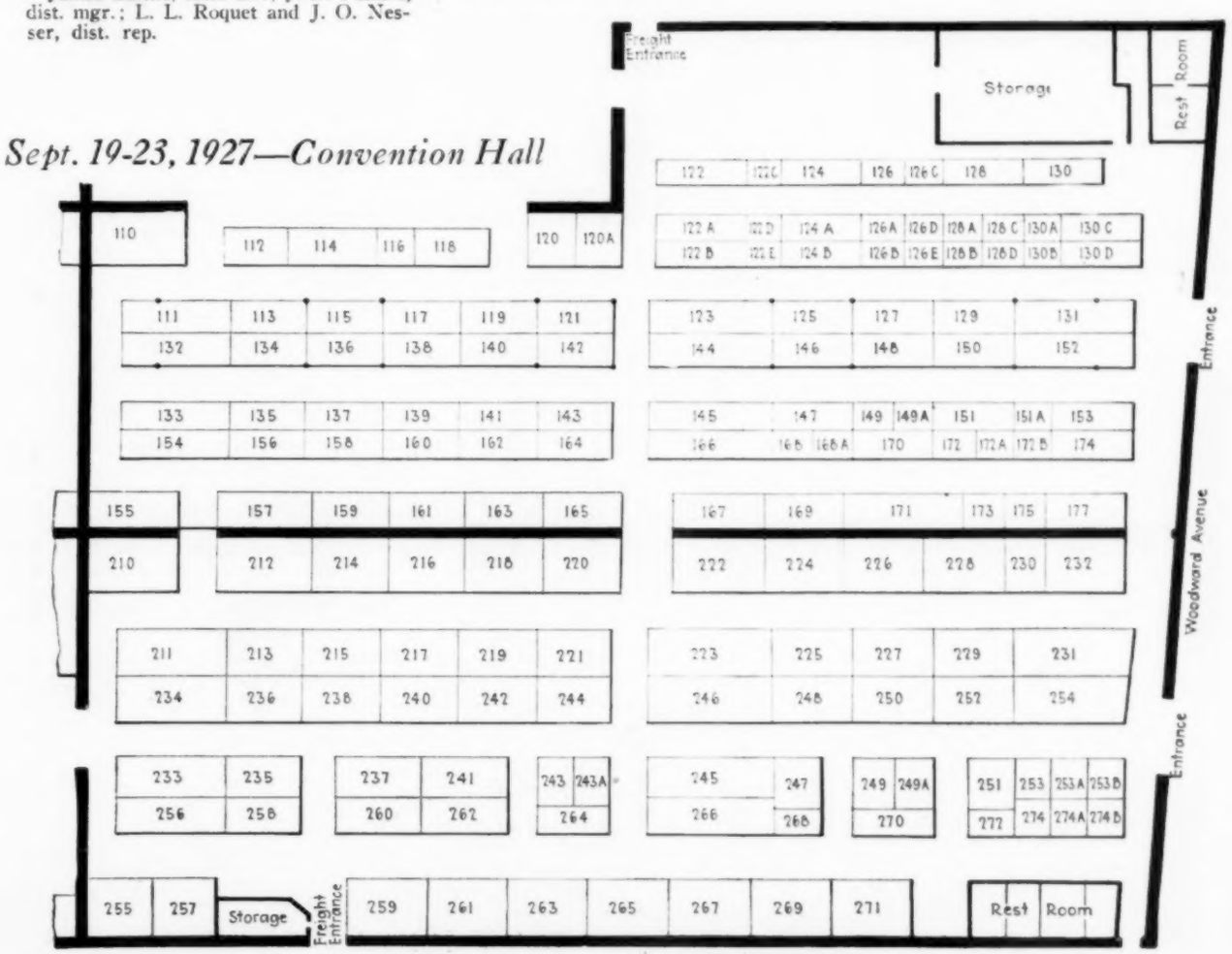
ANDRESEN AND ASSOCIATES, INC., F. C.—461A.

Publication, *Fuels and Furnaces*.

F. C. Andresen, pres.; I. Stanley Wishoski, mg. ed.; W. N. Robinson, engr. ed.

ARMSTRONG-BLUM MANUFACTURING CO.—461.

Marvel metal band saw, high-speed saw, automatic high-speed saw, hacksaw machines; high-speed-edge hacksaw blades.



Harry J. Blum, sec'y; Stanley A. Woleben, sales dept.; Joseph C. Fletcher, San Francisco office; Walter S. Ryan, Charles P. Ryan, Charles T. Ameel, Detroit office.

ARMSTRONG BROTHERS TOOL CO.—459.
Toolholders; lathe dogs; clamps; ratchet drills; drop forged wrenches; pipe vises; pipe cutters; stock and dies; pipe wrenches; and chain tongs.
Horace Armstrong, sales mgr.; Paul L. Armstrong, asst. supt.; A. F. Arbogast, George L. Nufer.

ARMSTRONG CORK AND INSULATION CO.—450.
Insulating brick and other high temperature insulating materials; corkboard, cork covering, linotile and cork tile; mechanical cork specialties.
W. C. Rasch, mgr.; J. N. O'Connor, R. H. Craig, R. L. Matthews, E. S. Hildreth, sales engrs.

ATKINS & CO., E. C.—214.
Silver-Steel hand and power hacksaw blades; Kwik-Kut power hacksaw machines; metal cutting bandsaw machine; Cantol belt wax; various saws.
Edward S. Norvell, mgr. metal cutting dept.; B. D. Tompson, Detroit; Robert Eveland, gen. rep. for Michigan; L. Blackwell, Indiana and Ohio, rep.; W. R. Chapin, metallurgist; E. C. Atkins, prod. mgr.

ATLAS STEEL CORPORATION.—440.
Hot-rolled, cold-drawn, and drop forged tool steel products of carbon, high-speed and special alloy steels; various dies, tools, jigs and fixtures together with performance data; regular and special types of stainless steels.
A. F. Dohn, pres.; F. B. Lounsberry, v.-p.; C. P. Burgess, v.-p.; W. H. Wills, metallurgist; J. C. Gearhardt, Detroit dist. sales mgr.; G. Eger, asst.; D. G. Hoyt, Detroit; W. Breeler, research metallurgist.

— B —

BARNES CO., INC., W. O.—488B.
Hacksaw blades and bandsaws; hacksaw machine; Red Arrow high-speed steel hacksaw blades.
W. O. Barnes, pres.; J. H. Flavell, treas.; C. B. Cecil, West. sales mgr.; F. M. Shaw, East. sales mgr.; C. G. VanTuyl, rep.

BARNES-GIBSON-RAYMOND, INC.—329.
Types of wire and flat springs of all materials. Leaf and cushion springs.
L. D. Adams, gen'l. mgr.; W. J. Black, sales mgr.; F. C. Adams, sales dept.; F. P. Zimmerli, ch. engr.; H. Rodemiger, supt.

BATH & CO., INC., JOHN.—228.
Ground thread taps; ground thread gages; ground thread rolling dies; progressive cut acme tap; internal micrometers; master rings.
John Bath, pres.; J. Chester Bath, v.-p.; R. E. Lamb, sec'y.; E. A. Walker, ch. engr.; S. W. Bath.

BAUSCH & LOMB OPTICAL CO.—340.
Modified and improved large metallographic equipment of particular interest to all metallurgists engaged in any sort of research work or in routine work requiring high magnification; toolmaker's microscope; centering gages, profile thread gage, and a general line of microscopes and devices for inspection of finished products and examination of raw materials.
Dist. reps., H. L. Shippy, Detroit; F. C. Lau, Chicago; W. A. Carter, Pittsburgh; I. L. Nixon, Rochester; W. L. Patterson, ch. of tech. bureau; G. Gallasch, tech. expert.

BELL & GOSSETT CO.—445.
Oil coolers; Caseite; Bohnite; lead bath covering Cleancoat; Non-case; Drawite; pressed steel pots.
E. J. Gossett, pres.; W. C. Bell, v.-p. and treas.; James S. Ayling, sales mgr.; B. C. Cleveland, metallurgist.

BELLIS HEAT TREATING CO.—117.
Lavite furnaces; work that has been heat-treated in Lavite; tempering Lavite; carbon and annealing Lavite; high-speed Lavite.
A. E. Bellis, J. W. Black, G. C. Davis, C. E. Wistar, R. C. Jordan, J. J. Lynch.

BELLEVUE INDUSTRIAL FURNACE CO.—121.
Pre-heater type cyanide hardening furnace for camshafts; burners; and fire brick.
W. E. Hinz, pres.; E. O. Hinz, sales dept.; L. J. Raymo, sales mgr.; C. Voelker, plant supt.; R. Trevathan, sales dept.

BEST CORPORATION, W. N.—326.
Photographs of furnaces and motion pictures of furnaces in operation.
H. B. Dempsey, mgr.; H. E. Vollmers, sales mgr.; W. F. Jones, sales engr.

BETHLEHEM STEEL CO.—313-315-332-334.
Products of interest to the automotive industry; fundamental steps in the production of steel; alloy steel; tool steel; Mayari pig iron; drop forgings; structural and rolled steel truck wheels.
A. P. Spooner, J. H. Stell, M. W. Dalrymple, G. B. Troxell, A. McDonald, W. Hartman, T. G. Foulkes, W. R. Shimer, Thomas Kiernan, J. S. Hegeman, Mathiew Ryan, David Roscoe, T. J. Fitzgibbons, R. S. Tucker, Robert MacDonald, F. H. Baldwin, C. E. Chamberlin, W. B. Pritchard, V. H. Miessner and F. E. Fisher.

BLAICH CO., ALFRED O.—340.
Blaich modern carbonizers; cyanides of all grades.
J. A. Howland, Wm. A. Anderson, S. W. Baldwin, and Joseph Pugh.

BLACK & DECKER MANUFACTURING CO.—216-218.
High-cycle, portable electric drills, electric screwdrivers, electric nut runners, and electric grinders; heavy-duty, electric grinders from 3 to 15 hp.; swing grinders; universal portable electric tools.
S. D. Black, pres.; W. C. Allen, sales supvr.; R. D. Black, adv. mgr.; R. E. Mizener, special rep.; W. A. Marschke, grinder div.; H. B. Hazerodt, Detroit branch mgr.; J. A. Fairfield, A. H. Walker, W. T. Johnston, W. J. Fenwick, H. B. Austin, salesmen.

BLAKESLEE & CO., G. S.—265.
Blakeslee Niagara-type parts washing machines; and Blakeslee pump-type parts washing machines.
John W. Dammers, sec'y.; George Anderson; A. L. Reichel.

BLISS & LAUGHLIN, INC.—371.
Cold-drawn steel, and turned and polished shafting; rounds, flats, squares and hexagons; parts and products manufactured from the foregoing.
Walter R. Howell, v.-p. and gen'l. mgr.; W. P. Mitchell, asst. v.-p.; T. D. Taylor, metallurgist. District sales mgrs.; C. L. Huff, Chicago; W. W. Wilson, Detroit; C. H. Beach, Indianapolis.

BOTFIELD REFRACTORIES CO.—154.
Adamant fire brick cement for various purposes; Adachrome for refractory coating mixtures; Adamant gun for applying refractory mixtures.
Axel H. Engstrom, sales mgr.; W. B. Smith, S. Latt, J. J. Sweeney, refractories engrs.; and J. G. Armstrong, Detroit rep.

BOURNE FULLER CO.—472.
Alloy and carbon steel; Climax alloy staybolt steel; bolts, nuts and rivets; tool steel; concrete reinforcing steel.
H. H. Pleasance, A. U. Klingman, C. F. Newpher, N. K. Hartford, H. D. Burket, T. W. McGrath, C. J. Brug, R. B. Gibson, W. B. Dunham, R. E. Ellas.

BOYER-CAMPBELL CO.—386.
Machines and tools manufactured by the following firms: B. C. Ames, Skinner Chuck Co., N. A. Strang & Co., La Porte Machine and Tool Co., Inc., William L. Procunier.
Warren Ames, pres.; Albert A. North, v.-p. and supt.; Clyde W. Blakeslee, sales mgr.; R. N. Brayer, engr.; Harry G. Procunier, genl. mgr.

BRISTOL CO.—274B.
The Bristo hollow head setscrews and capscrews; belt plates and belt rivets.
H. L. Griggs, genl. sales mgr.; J. B. Kelsey, asst.; E. C. Allen.

BRISTOL CO., THE.—335.
Automatic temperature controllers, and pyrometers; automatic valves connected to the pyrometers; electric panels with relays; recording and indicating pyrometers.
H. L. Griggs, genl. sales mgr.; J. B. Kelsey, asst.; C. W. Bristol, ch. engr.; dist. sales mgrs.: H. W. Moss, Detroit; L. G. Bean, Chicago; R. M. Walk, Pittsburgh, and C. C. Eagle, Philadelphia; and sales engrs., J. S. Mayberry and W. F. Emery.

BROWN & CO., D. P.—333A.
Teon belting; woven endless belts, black leather belts; compressed spruce pulleys; American pressed steel hangers.
William Rawle Brown, pres.; W. W. Nichols, v.-p. and mech. engr.; George I. Bouton, asst.; R. W. Holden, sales rep.

BROWN INSTRUMENT CO.—443.
Visible-type, multiple record, continuous chart recording pyrometer; standard indicating, recording signalling and controlling pyrometers; a working exhibit of the Brown mechanism for furnace fuel valve; instruments; electric, steam flow meter; flow meter manometer; indicating flow meter; recording and integrating flow meter.
R. P. Brown, pres.; George W. Keller, sales mgr.; R. W. Mayer, Detroit dist. mgr.; C. L. Saunders, Chicago dist. mgr.; Sherwin, Conwell, Frazee and Flowers, sales engrs.

BROWN LYNCH SCOTT CO.—429A.
Perfection carburizing compound cleanser and grader; a steel motor-driven sieving machine for cleaning and grading carburizing compound, sand or other materials.
F. C. Hoy, supt.

BROWN-MCLAREN MANUFACTURING CO.—457A.

BUCKEYE TWIST DRILL CO.—488.
Complete line of twist drills, reamers, special tools.
A. A. Mulac, J. F. Bell.

BUFFALO FORGE CO.—245.
Billet shears; universal iron worker; power bending roll, horizontal type; drills; forges, blowers and fans.
H. W. Wendt, Jr., v.-p.; E. G. Leonard, sales mgr.; A. T. Yates, service engr.; H. H. Weber, sales rep.; G. Zimmer, designing engr.; W. J. McDowell, A. T. Lamb, sales rep.

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CAMPBELL, INC., ANDREW C.—249.
No. 0 nibbling machine, for steel up to 14 gage; No. 1-A nibbling machine, for steel up to $\frac{3}{4}$ in. thick; No. 2 nibbling machine, for steel up to $\frac{3}{8}$-in.
Stuart Naramore, sales mgr.; J. Johnson.

CARBIC MANUFACTURING CO.—168A.
Carbic cakes (compressed carbide); low-pressure, portable generators; welding and cutting torches.
R. C. Duncan, J. L. Lowther.

CARBORUNDUM CO.—316.
Improved segmental chuck for use on Blanchard grinders; AA Aloxite toolroom wheels; quadruplex improved disks; Aloxite and Carborundum Redmanol cut-off wheels; rubber cut-off wheels; snagging wheels; cylindrical grinding wheels.
S. F. Courter, genl. sales mgr.; Anthony Dobson, dist. sales mgr.; F. J. Tone, Jr., John Storm, C. H. Niekamp, J. C. Gallen, H. S. Munroe.

CARBORUNDUM CO.—114.
Models of wire annealing furnace; car-type annealing furnace; recuperator; small gas fired furnace shows the relative thermal conductivity of Carbofrax, fireclay and Aloxite tile.
Dist. sales reps.: R. A. Beverley, Chicago; C. A. Dutton, Detroit and Cleveland; J. A. King, New England; W. M. Smith, industrial furnaces; S. A. Fenno, sales dept.

CARPENTER STEEL CO.—435-464.
Fine tools; airplane parts forged from engineering alloys; tools and utensils made of our various stainless steels.
F. A. Bigelow, pres.; J. H. Parker, v.-p.; W. S. Jones, v.-p.; R. V. Mann, asst. to pres.; F. R. Palmer, metallurgist; G. H. Edmonds, sales dept. Dist. mgrs.: J. B. Guthrie, Chicago; H. J. Joyce, Jr., Indianapolis; C. W. Olsen, Hartford; C. A. Heil, Cleveland; R. L. Williams, Detroit; J. M. Millard, Providence; F. W. Curtis, Cleveland; J. A. Nolan, Rochester; and F. C. Phillips, C. H. Breed and W. A. Armstrong, of Detroit.

CASE HARDENING SERVICE CO.—445.
Bohnite, case-hardening compounds; Caseite, cyanide hardening compound; Non-Case, anti-carbonizing paint; Pressteel pots; carbonizing boxes, alloy and steel; Drawite drawing salts; Bathite hardening salts; Cleancoat, lead bath covering; B-G, rapid oil cooler.
W. C. Bell, pres.; E. J. Gossett, v.-p.; J. S. Ayling, sales mgr.; W. H. Ogden, New York dist. mgr.

CELITE PRODUCTS CO.—141.
Heat insulating materials; high temperature cement; air-sealing compound for brick surfaces.
C. A. Frankenhoff, div. mgr.; John S. Means, T. E. Ventriss, H. N. Haberstroh, sales engrs.; and Walter K. Kennedy, steel plant rep.

CENTRAL ALLOY STEEL CORPORATION.—428-432.
Racing car designed and built by Earl Cooper; Enduro stainless iron; Agathon alloy steels; Tongan copper molybdenum iron.
J. M. Schlendorf, v.-p. of sales; B. F. Fairless, v.-p. and genl. mgr.; A. Schaeffer, Detroit dist. sales mgr.; J. R. Morris, asst. metallurgical engr.

CENTRAL STEEL AND WIRE CO.—172A.
Westinghouse single operator 200 ampere electric welder; Swedox electrodes and filler rods; hot rolled steel; wires and magnets.
J. G. Norris, mgr. welding wire dept.; J. S. Gorman, Detroit mgr.; F. S. Hunt, Detroit sales mgr.

CHAMBERSBURG ENGINEERING CO.—231.
Working models of forging equipment; sample forgings.
O. C. Mahon, G. R. Murray, Racine Ripley, D. M. McDowell, E. B. Huber, E. R. Frost, J. H. Friedman, D. J. Crowley, K. L. Ernst, C. D. Harmon, and Clyde Bordner.

CHAMBERSBURG-NATIONAL.—231-254.
Forge equipment. This is the sales organization of the Chambersburg Engineering Co. and the National Machinery Co. Further listings appear under these two names.

CHAR PRODUCTS CO.—377.
Carburizing compound, annealing carbon and carbon products.
C. B. Edwards, chem. engr.; William Higburg, sales mgr.

CHESTERFIELD METAL CO.—235.
High-speed cutting alloy in the form of cutting tools and bar stock. Also special castings having a high wear resistance.

CHICAGO PNEUMATIC TOOL CO.—224-226.

CHICAGO SCREW CO.—328.
Hardened and ground alloy bolts, made by the upset head process and milled from the bar; special screw machine products in brass; cold headed upset; large screw machine work.
G. E. Snyder, sales rep. for Michigan; W. J. Finn, sales mgr.

CHICAGO STEEL FOUNDRY CO.—323.
Pyrasteel heat and acid resisting alloy; carburizing pots and boxes; oil burner parts; miscellaneous castings; Evansteel alloy for resistance to wear and abrasion.
David Evans, pres.; A. Blackwood, genl. mgr.; C. McA. Evans, Herman J. Georgen, sales rep.

CHISHOLM-MOORE MANUFACTURING CO.—348.
Cyclone high-speed chain hoist; chain hoists; roller bearing trolleys; I-beam trolleys; electric hoists; overhead traveling cranes.
J. R. Mears, sales mgr.; E. J. Newton, Detroit dist. mgr.; W. H. Morgan, sales engr.; F. F. Seaman, mgr. elec. hoist dept.

CHROBALTIC TOOL CO.—417A.
Heat resisting and special alloy castings; electric resistance grids; retorts for gas carburizing furnaces; Valencite compound for improving physical and machining properties of cast iron.
W. B. Sullivan, v.-p. and mgr.; L. H. Whiteside, Chicago; J. W. Mull, Jr., Indianapolis; A. A. Cash, Detroit; C. M. Conner, Philadelphia.

CINCINNATI PLANER CO.—261.
Hypro planer with Keller automatic electric contour planing device, planing irregular outlines; open-side crank planer.
B. B. Quillen, pres.; George Langen, v.-p.; C. E. Linden, sales mgr.; O. C. Willey, supt.; and George Lamoth, planer foreman.

CLIPPER BELT LACER CO.—247.
Belt lacers; belt hooks, including rust-proof hooks; belt cutters.
Earl H. Forsyth, fact. rep.

CLARK TRUCTRACTOR CO.—412.
Tructractor, three wheeled, gasoline propelled industrial truck; Truclift, gasoline powered industrial lift truck; Clarkat, small gasoline industrial tractor built for use in narrow aisles; Steel trailer, rubber tired.
J. W. Taylor, mgr., Detroit; R. J. Burrows, pres.; Ezra W. Clark, v.-p.; C. I. Ucker, mgr., Pittsburgh.

CLEVELAND TWIST DRILL CO.—111-113-132-134.
Two high-power drill presses demonstrating Cle-forge high-speed drills in steel and cast iron; a high-speed sensitive drill press for brass drilling; Spirex machine pin reamers and exhibit showing the cutting action of a drill.
W. E. Caldwell, mgr. of sales; H. P. Jenson, asst.; sales reps.: A. J. Ireland, H. E. Bergquist, F. M. Hoelzle, H. Puckhaber, I. P. Farnum, Thomas Thomas, F. A. Kelly, J. C. Hogan; H. J. Baier, ch. engr.; J. B. Dillard, genl. supt.; T. M. Skove and D. D. Burdette, asst.

CLIMAX MOLYBDENUM CO.—416.
Molybdenum ores and products.
B. F. Phillipson, pres.; F. C. Langenberg, v.-p.; Alan Kissock, W. P. Woodside, J. Kent Smith.

COLONIAL STEEL CO.—449-476.
Miscellaneous grades of tool steel; processes of manufacture; die blocks; forgings; special shapes; well, bit, and jar steel; axe and razor steel; fractures of heat-treated specimens of different grades.
R. M. Brushingham, Detroit dist., mgr.; Lawrence Wood, genl. sales mgr.; T. Howe Nimick, asst.; N. B. Hoffman, E. P. Geary, G. B. Ferguson, met. dept.; L. T. McKinnon, H. L. Welsh, W. J. Smale, Detroit sales office; R. W. Harris, Cleveland; J. S. Froelich, Chicago.

COLUMBIA TOOL STEEL CO.—133.
Principal exhibit demonstrates Clarite high-speed steel; Maxite super high-speed steel; Superdie high-carbon, high-chromium alloy; Oildie chromium-tungsten non-shrinking steel; Buster brand alloy shock-resisting steel; special carbon steel; extra carbon steel and standard carbon steel.
Arthur T. Clarage, pres.; dist. sales mgrs., Alex Luttrell, Detroit; G. C. Beebe, Cleveland; F. A. Terry, Cincinnati; E. H. Pasmore, Chicago; A. J. Scheid, Milwaukee; B. H. Phillips, A. N. Johnston, W. G. Sonderman, E. D. Roberts, and L. E. Dallas.

COOPER-HEWITT ELECTRIC CO.—213.
Work-light arranged in the machine tool section as nearly as possible like standard practice; Kon-nec-tor enclosed mercury switches; Induction Lamp.
Charles F. Strebig, sales mgr.; D. R. Grandy, commercial engr.; H. M. Ferree; G. R. Clover, Detroit; H. T. Braschler, Chicago; W. W. Becky, Cincinnati.

CRAINE-SCHRAGE STEEL CO.—312.
Cold-drawn bar steel; hot-rolled tool steel; cold-rolled strip steel.

C. D. Craine, Pres.; Charles H. Walker, mgr. tool steel dept.; F. L. Woodside, W. B. Wiley, J. S. McClelland, R. W. Jones, T. E. King.

CRUCIBLE STEEL CO. OF AMERICA.—337-339-341-356-358-360.
Apparatus demonstrating the salt spray test on non-corrosive metals; parts made of various grades of non-corrosive, high-speed, H. Y. C. C., tool, alloy and machinery steel; cold-drawn specialties.
F. B. Hufnagel, pres.; J. A. Mathews, v.-p.; A. T. Galbraith, v.-p. and genl. mgr. of sales; R. W. Crane, Detroit; F. E. Phelps, Cleveland; A. H. Kingsbury and I. S. Warren.

CUSHMAN CHUCK CO.—310.
Lathe chucks.
Harry E. Sloan, v.-p.; Harry W. Hultgren, special rep.; George H. Pratt, sales mgr.; and George Highberg, mech. engr.

CYCLOPS STEEL CO.—385A.
Sheets of carbon and alloy steels, showing hacksaw, gin saw, handsaw, circular saw, cutlery, magnet, high-speed agriculture disk and soft center steels, etc.
Charles Evans, genl. mgr.; Charles Ridgeway, sales dept.; A .F. McFarland, Detroit rep. Rep. Universal Steel Co., J. O. Rinek, asst. genl. mgr.; W. G. Miller, genl. supt.; Frank Garratt, sales metallurgist; Frank Saltsman, sales dept.; H. M. German, metallurgist; H. C. Copp, Jr., met. dept.

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DANLY MACHINE SPECIALTIES, INC.—212.
Die sets; leader pins; bushings; die shoes; punchholders; dowel pins; pry bars; goose neck clamps; swivel head capscrews; automatic stock stop for punch-presses; Unbrako hollow head capscrews; pressure pad springs; stripper bolts; laps and lap arbors; and Danly transparent die set templets.
P. H. Danly, v.-p. and genl. mgr.; Arthur G. Henry, metallurgist. Dist. mgrs.: A. G. Gullberg, Detroit; A. L. Miller, New York; H. F. Landon, Chicago. Sales engrs., Joseph Felber, A. F. Wallace; and J. R. Fitzsimmons, factory rep.

DARWIN & MILNER.—318-320.
General line dies and various tools; special alloy steels; Neor brand, and Cobalt-Crom PRK-33.
V. F. J. Tlach, pres.

DAVISON GAS BURNER AND WELDING CO.—116.
Gas burners on line pressure, and with forced draft; low pressure fuel oil burners; domestic oil burners.
F. F. Davison, v.-p.; Edward Poor, supt.

DEARBORN CHEMICAL CO.—477.
No-ox-id, rust preventive; powdered cleaner.
E. M. Converse, dept. of specialties; C. I. Loudenback, Detroit mgr.; J. A. Crenner, Pittsburgh mgr.; C. A. Remsen, New York.

DETROIT SEAMLESS STEEL TUBE CO.—458.
Seamless steel tubes, cold drawn and hot-rolled for the automotive industry; locomotive, marine and stationary boilers. Also for chemical and paper industries.
C. H. Hobbs, pres. and genl. mgr.; S. H. Worrell, genl. mgr. of sales; H. E. Ross and R. Berryman, special reps.

DETROIT SHEET METAL WORKS.—391.
Self-cleaning metal parts washing machine, for removing oils, chips, drawing compounds, etc., from stamped or machined parts; industrial ovens; drying and baking processes.
Wedworth V. Baker, William C. Ehmka, M. J. Whiting.

DISSTON & SONS, INC., HENRY.—480-482.
Cut-off band, and hacksaws; metal cutting saws; hacksaws; files; steel; products made of Disston steel.
S. Horace Disston, v.-p.; D. W. Jenkins, genl. sales mgr. of domestic div.; J. C. Forrest, mgr. metal saw dept.; H. A. Baxter, mgr. steel sales; Joseph L. Dorrington and Edward P. Ludy.

DONNER STEEL CO., INC.—487.
Various die rolled automotive parts.
W. V. Vosmer, v.-p.; J. W. Donner, genl. supt.; A. G. Greenamyer, asst.; C. A. Cherry, asst. to v.-p. Dist. mgrs.: E. D. Pumphrey, Detroit; P. M. Guba, New York; H. C. Richardson, Cleveland; M. D. Morris, supt. forming mill. Met. engrs.: R. E. Sherlock and W. C. Peterson, T. J. Woods, and F. H. Lammert.

DRIVER-HARRIS CO.—470.
Full line of Nichrome castings, wire products and other miscellaneous products manufactured by this concern.
W. E. Blythe, dist. mgr.; L. H. Waldrip, L. V. Prior, H. D. Tietz, sales engrs.; J. C. Bilek, dist. mgr. Chicago; H. D. McKinney, genl. sales mgr.

DUNHAM CO., KEITH.—131.
Complete oxygen and nitrogen production plant, showing oxygen produced from the air; seamless acetylene cylinders; welding and cutting apparatus; new process bends, with uniform wall thickness.
M. Keith Dunham, pres.; L. M. Zimmer, v.-p.; C. J. Haines, v.-p.; David A. Ahldin, consl. engr.; Don B. McCloud, L. O. X. div.; J. W. Dunham, engr; L. Zengeler, ch. erector.

DURIRON CO., INC.—431.
Acid proof material; Duriron and Alcumite.
Thomas C. Corin, dist. rep.; W. E. Pratt, sales mgr.; E. B. Thacker.

— E —

ECLIPSE FUEL ENGINEERING CO.—North Woodward Annex.
Forges, rivet heaters and furnaces for high and low pressure gas.
G. W. McKee, pres. and genl. mgr.; O. M. Olsen, sales mgr.; K. A. Scharbau, supt.; E. T. Stoner, service mgr.; H. O. Hoffman, prod. mgr.; L. J. Strohmeyer, adv. mgr.; O. N. Sellers, mgr. boiler dept.; Albert Stadler, blower dept.; and H. F. Wemple, furnace dept.

ECLIPSE INTERCHANGEABLE COUNTERBORE CO.—216.
Counterbores, core drills, reamers, etc.; automotive parts, including cylinder blocks, connecting rods, transmission cases, etc., with tools for machining.
R. G. Mitchell, genl. mgr.; A. C. Warn, asst.; J. H. Smith, ch. engr.; sales reps., C. M. Bigger, O. W. Dawson, S. D. Gafford, H. E. Berry, T. J. Fraser, F. E. Harrison.

EDLUND MACHINERY CO., INC.—264.
Standard drilling machines.
John Edlund, Carl Edlund, H. K. Edlund, Robert Berry.

ELECTRIC ARC CUTTING AND WELDING CO.—172B.
Welding equipment.
C. J. Holslag.

ELECTRIC FURNACE CO.—164.
Literature and engineering information relative to electric heat-treating furnaces of all types.
R. F. Benzinger, v.-p.; F. T. Cope, ch. engr., F. J. Peterson, Detroit rep.; A. H. Vaughn, asst. ch. engr.; S. Floyd Keener, T. B. Bechtel, N. H. Knowlton, engrs.

ELECTRO ALLOYS CO.—327-346.
Thermalloy retorts; carbonizing boxes; cyanide pots; combustion chambers; recuperators; furnace parts.
A. L. Garford, pres.; W. C. Whyte, v.-p.; J. B. Thomas, treas.; J. W. Henry, metallurgist; R. B. McMullen, Jr., A. M. Miller, Jr., W. J. Hansen, R. B. McMullen, Sr.

ELECTRO REFRACTORIES CORPORATION.—353B.
Silicon carbide brick in various shapes and sizes; a high temperature cement.
Luke U. Milward, pres.; David Milward, sales; Grant Diamond, chf. chemist.

ELKON WORKS, INC.—153A.
Elkonite welding electrodes for heavy pressure, flash welding, projection welding, heavy-duty dies, rivet heating, etc.
G. N. Sieger, genl. mgr.; J. A. Weiger, chf. engr.; J. C. Cox, engr.; R. R. Tomkins, sales rep.

EMERY-TATNALL CO.—336.
Tension testing machines of hydraulic type, steel construction, totally inclosed and flood lubricated; requires no foundation.
A. P. Lohmann, pres., Philadelphia; A. H. Emery, Jr., v.-p., Stamford, Conn.; Francis G. Tatnall, v.-p., Philadelphia.

ENDICOTT FORGING AND MANUFACTURING CO., INC.—462.
Drop forgings from carbon and alloy steel
S. J. Marshall, pres.; George B. Reed, sales.

ENGELHARD, INC., CHARLES.—395.
Pyrometers, recording and indicating; thermocouples; thermo-couple protecting tubes; automatic control; electric resistance thermometers; CO_2 and SO_3 gas analysis apparatus.
G. E. Pierce, plant mgr.; J. H. Oetjen, engr.; N. M. Salkover, dist. rep.; G. F. Newell, St. Louis dist. mgr.

K. ENGELSTED.—481.

ERIE FOUNDRY CO.—250.
Products of company.
D. A. Currie, v.-p. and genl. mgr.; H. E. Reed, genl. supt.; L. F. Walker, sales rep.; L. F. Carlton, Chicago rep.; R. B. McDonald, Detroit rep.; George O. Desautels, Indianapolis rep.; M. S. Reed, sales engr.

EX-CELL-O TOOL AND MANUFACTURING CO.—211.
High-speed internal grinder spindles; high-speed ball bearings; standard drill jig bushings; jigs equipped with standard bushings.
N. A. Woodworth, pres. and genl. mgr.; Philip H. Huber, sec'y.; C. R. Alden, mgr. of sales; F. D. Sicklesteel, asst.; William F. Wise, prod. engr.; J. R. Haycock, W. B. Montgomery, Frank Strother, sales; James Fulks, demonstrator; L. K. Goss, H. E. Henry, Cleveland rep.

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FAUVER CO., INC., J. N.—314.
Pressure lubricating devices; centralized lubrication systems; automatic controlled feed lubrication systems; air operating devices for machine tools.
C. R. Trimmer, v.-p.; A. W. Smith, rep.; H. H. Barrows, E. Rathbun, sales engrs.

FEDERAL MACHINE AND WELDER CO.—152.
Electric spot welder foot operated; electric butt welder.
F. P. McBerty, pres.; Mrs. A. Z. McBerty, sec'y and asst. treas.; Albert E. Hackett, dist. mgr.

FEDERAL PRODUCTS CORPORATION.—302A.
Dial gages and indicators; various types of inspection tools using the indicator method of measuring.
L. C. Tingley, genl. mgr.; C. G. Gilbert, Detroit mgr.; H. H. Root, service mgr., Detroit.

FERNER CO., R. Y.—237.
Jig boring machine, having two horizontal and one vertical spindle.
R. Y. Ferner, American agt. of Societe Genevoise d'Instruments de Physique; Walter S. Ryan, Detroit rep.; Charles T. Ameel, sales engr.; M. Stucki, demonstrator; Patrick Ryan, sales.

FERRY CAP AND SET SCREW CO.—310.
Standard cap and set screws of various types; connecting rod bolts; special bolts.
H. D. North, v.-p.; W. M. Leach, dist. mgr., Detroit; A. L. Whittemore, dist. mgr., Chicago.

FINKL AND SONS, CO., A.—456.
Drop forge supplies; die blocks; piston rods, hammer rams, (steam and board), hot work die steels, etc.
Chas. Finkl, genl. mgr.; Wm. Finkl, M. R. Chase, meta. engrs.; Fred Finkl, plant mgr. Dist. salesmen: E. H. Graham, Detroit; T. P. Wallace, Cincinnati; J. M. Curley and W. L. Goodrich, New England, and W. H. Rieger and F. R. Erb, Pennsylvania.

FIRTH STERLING STEEL CO.—422, 422A and 424.
Tool and die steel; high-speed tool steel; small size octagons.
L. Gerald Firth, genl. mgr.; Robert S. Stevick, wks. mgr.; O. K. Parmiter, met. engr.; G. J. Comstock, dir. of research; A. S. Martin, adv. mgr.; D. G. Clark, dir. of sales. Dist. mgrs.: A. E. Barker, New York; O. T. Smith, Boston; H. I. Moore, Connecticut; E. T. Jackman, Chicago; G. A. Jacobs, Detroit; William Ely Nelson, Los Angeles; and Willard C. Royce, Cleveland. Salesmen, E. E. Roberts, R. F. Kimber, George J. Bauer, C. O. Ericke, C. E. Hughes, F. N. Mead, I. Olsen, L. S. Russell, Joseph Smith, J. A. Wotan, R. H. Hallagan, F. E. Crocker, Lloyd W. Mead, C. D. Moore, Wade H. Davis, C. C. Hamilton, Thomas A. Larecey, W. A. Nungester. Also W. J. Schulty; Frank Marth; H. L. Wineland.

FORD CO., J. B.—304.
Specialized metal cleaners adapted for metal surfaces before plating, japanning, enameling, etc.
B. N. Goodell, mgr. of the indust. dept.; W. M. Cole, C. S. Tompkins, C. R. Beaubien, S. H. Renton, assts.

FREDERICKSON CO.—390.
Sabeco bearing bronze.
R. F. Agricola, pres.; Arthur A. Schupp, genl. mgr.; Henry Limbach, Ralph Sherry.

FUSION WELDING CORPORATION
affiliated with
CHICAGO STEEL AND WIRE CO.—168.
Welding generator and welding rods. Exhibit will be confined entirely to fusion welding.
J. B. Green, pres.; F. B. Toombs, genl. sales mgr.; J. E. Wolcott, Cleveland dist. mgr.; K. L. Hansen, elec. engr.; R. W. Holt, and J. J. Sacks, research engrs.

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GAIRING TOOL CO.—243A.
Four complete and distinctive types of counterbores and spotfacers; chucking reamers; inserted blade cutters; grinding fixtures.
E. Gairing, pres. and genl. mgr.; J. K. Murdock, supt.; B. O. Meara, sales engr.; A. J. Hilderschied, Detroit rep.; H. E. Richmond, Michigan rep.

GATERMAN MANUFACTURING CO.—253.
Pneumatic oscillating tapping machines.
W. Gaterman, E. Gaterman, F. H. Kind.

GATHMANN ENGINEERING CO.—365-384.
Ingots; ingot molds; shrink head casings; improved methods of steel production.
Emil Gathmann.

GENERAL ALLOYS CO.—411-438.
Q-Alloy carburizing boxes; cyanide and lead pots; retorts; muffles; glass dies; conveyor chains; enamel burning racks; cyanide dipping baskets, etc.
H. H. Harris, pres.; W. K. Leach, genl. mgr.; A. L. Grimnell, mgr. Detroit dist.; J. J. Donovan, Chicago; G. C. McCormick, ch. engr.; Robert M. Kirk, New York; W. A. Tuthill; A. D. Heath, Indianapolis; H. G. Chase, Cleveland; and Walter H. Ogden, Binghamton.

GENERAL ELECTRIC CO.—110 (Furnaces); 127-148 (Welding).
Electric furnaces and general exhibit of electrical equipment.
C. T. McLoughlin.

GIBB WELDING MACHINES CO.—150.
Small spot welder; large spot welder; standard seam welder; special HO-type seam welder and one arc welder.
W. H. Gibb, pres.; J. R. Brueckner, sec'y-treas; H. V. Beronius, Detroit; C. O. Watson, Chicago; W. O. Little, Cleveland; R. D. Thomas, Philadelphia and New York; Charles Rusk, Philadelphia; G. T. Myers, Cincinnati; Victor Larson, Montreal; Arthur Jackson, Toronto; John Toleik, ch. engr.

GILBERT & BARKER MANUFACTURING CO.—474.
Gas and oil fired heat-treating furnaces; oil burners and oil burning systems.
M. K. Epstein, sales mgr., industrial sales div.; F. E. Gibson, Detroit rep.; and S. L. Hauser, Pittsburgh rep.

GODDARD & GODDARD CO., INC.—240.
Milling cutters, both profile and formed types.
A. N. Goddard; J. K. Murray; Ed. Rummins; E. J. Lipa; A. D. Schneider; C. S. Goddard.

GOODELL-PRATT CO.—274B.
Portable electric drills; precision tools and measuring instruments; mechanics' hand tools.
F. W. Pratt, Karl C. Rupert and C. L. Jernberg.

GORDON CO., CLAUD S.—253A.
Pyrometer switches and cabinets; protecting tubes; nickel-chromium tubes; cyanide and salt bath tubes; service magnets; thermocouples.
Claud S. Gordon, pres.; Richard Schoenfeld, sales mgr.; S. A. Silberman, Indiana dist. service engr.

GOSS & DELEEUW MACHINE CO.—234A.
Multiple-spindle, automatic chucking machine, single threading.
J. E. Bullock; Stanley T. Goss, pres.; J. J. Spring, sales engr.; E. H. Peck, demonstrator.

GROOV-PIN CORPORATION.—266B.
Groov-pins in various diameters up to ½-in.
John A. Richter, v.-p.; B. H. Gerker, dist. rep.; Frederick C. Mensing, v.-p.

— H —

HAGAN CO., GEORGE J.—143.
Data on installations of electric, gas, oil, and coal furnaces.
R. E. Talley, pres.; C. F. Cone, engr.; J. Sandberg, Detroit; V. A. Hain, Chicago; J. L. Edwards, A. D. Dauch, engrs.

HALCOMB STEEL CO.—339-341.
Stainless steels, iron and non-corrosive alloys; tools made of Dreadnought, Marathon, Ketos and carbon steels; automotive parts, made by Halectralloy alloy steels.
H. A. Pardee, mgr.; H. J. Stagg, asst.; Charles Schramm, supt.; S. C. Spalding, metallurgist; M. P. Spencer, asst. sales mgr. Dist. mgrs: H. Barlow, New York; T. F. Wood, Syracuse; J. F. Kirwan, Cleveland; J. H. Hinkley, Chicago; A. Schroeder, Detroit. George Disque and Harry Lang, sales.

HASKINS CO., R. G.—256B.
Flexible shaft equipment.
Fred J. Neubauer, sales mgr.

HEPPENSTALL FORGE AND KNIFE CO.—489.
Split and open hearth ingots; shear knife grinding wheel chuck.
C. W. Heppenstall, pres.; B. B. Weinberg, genl. sales mgr.; C. J. Sauer, genl. mgr.; A. J. Porter, sales mgr., of the Heppenstall Forge Co.; Frank C. Moyer, Heppenstall Steel Co., Detroit; J. A. Succop, ch. of metallurgical research. Dist. reps: G. J. Allen, Cleveland; A. L. Wurster, Philadelphia; George O. Desautels, Indianapolis; L. A. Daines, Chicago; D. A. Stuart, Pittsburgh.

HEVI DUTY ELECTRIC CO.—159.
Electric carbonizing furnace; box type tool treating furnaces; pot type furnace; tempering bath furnace; laboratory furnaces.
E. L. Smalley, pres.; F. A. Hansen, mgr., C. H. Stevenson, Chicago rep.; Edward Busch, Cleveland rep.

HILL-CURTIS CO.—258.
Single-spindle speed lathe; two-spindle speed lathe; victory lathe; heavy-duty lathe; grinders.
H. J. Kingsbury, chf. engr. and sec'y.

HOLCROFT AND CO.—120-120A.
Electric high-speed tool hardening furnace; standard electric forging furnace; special conveyor gas fired furnace for hot press forging or heat treating.
C. T. Holcroft, pres.; R. T. Cadwell, v.-p.; H. L. Ritts, sec'y-treas.; reps.: A.

Rukstahl, C. H. Martin, J. B. Pollard, E. M. Smith; C. L. Joy, ch. engr.

HOLLUP CORPORATION, C. H.—172.
Welding wire and equipment for electric arc welding; Wanamaker flux coated electrodes; Rex bare electrodes; Rex copper coated welding rods.
H. R. Pennington, pres.; K. R. Hare, sales mgr.; A. A. Weigel, sales rep.; T. M. Butler, pres.; D. E. Cunningham, rep, Welding Service and Sales Co., Detroit, distributors.

HOSKINS MANUFACTURING CO.—142.
Electric toolroom furnaces; pyrometers; chromel resistance material.
W. D. Little, sales mgr.; C. S. Kinnison, adv. mgr.; H. T. Hayes, export mgr.; W. A. Gatward, ch. engr.

HOUGHTON & CO., E. F.—463-490.
Salt baths, Vim leather, packings, lubricating oils, etc.; carburizing materials; cutting oils; cylinder oils; core oils; drawing compounds; heat treating salts; pickling compounds; quenching and tempering oils; rust preventive; cyanides; cleaning materials.
R. H. Patch, F. L. MacNamara, H. E. Cressman, C. N. Vincent, L. F. Reid, R. H. McCormick, C. E. Murdock, W. J. Wright, Geo. W. Pressell, L. C. Dunn, Geo. S. Rogers, E. C. Barlow, A. J. Jennings, W. G. Harbert, H. E. Beland, C. G. Schultze, J. Coleman Bentley.

HUNTER SAW AND MACHINE CO.—415.
High-speed metal cut-off saws; inserted tooth saws; friction disks; rivet sets; chisel blanks; hot and cold saws.
F. A. Hunter, Sr., pres.; F. A. Hunter, Jr., sales mgr.; Carl Schnubel.

HUTTO ENGINEERING CO., INC.—244.
P. D. Bates.

— I —

IDEAL INDUSTRIAL MACHINERY DIVISION, CONSOLIDATED CONCRETE MACHINERY CORPORATION.—237A.
Ideal automatic loading and unloading tumbling barrel with sawdust separating screen and power loader.
N. Ransohoff, v.-p. and genl. mgr.; C. A. Albrecht, Newark; D. M. Powers, Cleveland; H. E. Epley, Detroit; J. H. Hopp, Chicago.

ILLINOIS STEEL CO.—331-333-350-352.
Miniature models of a blast furnace, open hearth, electric furnace, and rolling mill.
W. I. Howland, Jr., asst. genl. sales mgr.; G. A. Price, bar div.; A. L. Meyer, alloy div.; C. R. Moffat, adv. mgr., Chicago; F. S. Crane, R. G. Glass, C. E. Shattuc, E. J. Janitzky, F. W. Bendell, F. B. Mulvaney, dept. metallurgy and inspec., Robert Korsan, S. L. Graham, Chicago dist. office; John Hornbrook, G. W. Landrus, J. H. McKown, H. R. Merritt, Detroit dist. office.

ILLINOIS TOOL WORKS.—455.
Milling cutters, hobs, etc.
S. O. Bjornberg, consult. engr.; P. J. Nelson, sales mgr.; Dan P. Murphy, Detroit rep.; J. McAllister Gribbie, sales mgr., Shakeproof Lock Washer Co.

INTERNATIONAL NICKEL CO.—475.
Commercial forms and examples of interesting applications of nickel and its alloys.
F. S. Jordan, sales mgr.; R. A. Wheeler, nickel dept.; A. J. Wadhams, mgr. devel. and research dept.; P. D. Merica, dir. of research; R. L. Suhl, devel. engr. T. H. Wickenden, Charles McKnight, Jr., J. S. Vanick, R. G. Waltenberg, D. M. Houston.

INTERSTATE IRON & STEEL CO.—419-448.
Rounds, squares, flats, octagons, hexagons, in both hot rolled and cold drawn finish.
W. J. MacKenzie, v.-p.; E. Larned, ch. metallurgist; W. H. C. Carhart, S. A. Richardson, asst.; J. F. White, sales.

Iron Age—414.
F. J. Frank, pres.; C. S. Baur, gen. adv. H. E. Barr, eastern New England; Emerson Findlay, Central-West; Don G. Gardner, Southwest; B. L. Herman, western New York State; C. Lundberg, Philadelphia; Pierce Lewis, Detroit; C. H. Ober, New York; W. B. Robinson, Pittsburgh; W. C. Sweetser, New Jersey; D. C. Warren, western New England; F. S. Wayne, western U. S. A.; C. E. Lachaussee, asst. to gen. adv. mgr. Editors—A. I. Findley, W. W. Macon, E. F. Cone, R. E. Miller, C. E. Wright, G. L. Lacher, S. G. Koon, E. E. Thum, T. H. Gerkin, G. S. Herrick, F. L. Prentiss, Cleveland; G. F. Tegan, Pittsburgh, R. A. Fiske, Chicago; B. Finney, Cincinnati.

— J —

JARVIS CO., CHAS. L.—238A.
Demonstration of single and multiple tapping.
M. N. Jarvis, pres.

JESSOP STEEL CO.—454.
Stainless products; finished products from sheet bar mills; specimens of worn punches, dies, etc.
S. A. Grayson, pres.; F. T. H. Youngman, sec'y-treas.; R. K. Greaves, Detroit mgr.; D. J. Hanna, Detroit; W. A. Salt, Chicago mgr.; C. M. Cunningham, Chicago rep.; J. C. Dawson, Canadian mgr.; V. M. Wellman, Cleveland mgr.; W. J. Frederick, Cincinnati rep.; J. M. Curley, Boston rep.; A. J. Lambert, Washington, Pa.

JONES AND LAUGHLIN STEEL CORPORATION.—354.
Jalcase steel; hot and cold finished steel; cold finished products.
F. D. Heath, Detroit dist. sales mgr.; R. W. Light, W. E. Danz, Detroit; W. B. Todd, mgr. of sales cold finished sales dept.; J. D. Allen; J. S. Grumbling, metallurgical dept.; A. A. Wagner, asst. mgr. of sales, hot rolled sales dept.

— K —

KELLER MECHANICAL ENGINEERING CORPORATION.—259.
The Kellocater, an electrically controlled jig boring unit, capable of doing accurate locating and jig boring.
Jules Dierckx, v.-p.; C. Bitter, D. F. Butler, L. Desautels, A. Keller, R. B. Shaw.

KELLEY CO., J. W.—345.
Carburizing compound; heat-treating salts; quenching oils; tempering oils; lubricating oils and allied products; Greene quenching and washing machine.
J. W. Kelley, pres.; H. B. Northrup, sec'y; J. E. Burns.

KELLY REAMER CO.—308.
Adjustable boring and reaming tools for general and production purposes, including single point tools, block unit, roughing and finishing tools and others.
H. C. Putnam, pres.; William Peterson, Detroit mgr.; D. E. Van Deusen.

KEMP MANUFACTURING CO., C. M.—North Woodward Annex.
Proportional air and gas mixing apparatus; internally fired lead pot; heated air blasts; brazing and welding burners.
W. W. Kemp, W. M. Ponder, W. S. Bassett, William Hunt.

KEYSTONE LUBRICATING CO.—306.
Pneumatic safety lubricator for group or department lubrication from a central point; ball and roller-bearings.
H. A. Buzby, pres. and genl. mgr.; P. Cassady, western mgr., Chicago; M. C. Schwenk, Michigan rep.; T. B. Little, steel mill rep., Pittsburgh; F. D. Street, sales eng. dept., Philadelphia; C. O. Norstrum, lubricating engr., Phila.

KIDDER FURNACE CO.—136.
Semi-muffle type heat-treating furnaces, gas fired, of single unit design with motor and fan built in.
A. B. Kidder, F. M. Buckius.

KING REFRACTORIES CO., INC.—355.
Flame brand high temperature cements and Mono baffles.
S. C. Smith, pres.; R. A. Smart, William Gaertner, Harry J. Ransley.

KINITE CORPORATION.—367.
Kinite and Kompite castings; Kinite dies; stampings from Kinite and Kompite dies; patterns for Kinite castings.
P. H. Dorr, pres.; E. J. Mohr, sales mgr.; K. L. Clark, F. Henderson, dist. reps.; T. A. Moormann, metallurgist.

KREMBS AND CO.—153.
Brazing and welding fluxes. Kwik-flo spelter solder; special brazing solders; Fluxine coated rods; flux container and rod holder; dip-brazing furnace.
O. M. Krembs, pres.; P. C. Tris, consulting metallurgist; L. J. Schanz, eng. dept.

— L —

LA PORTE MACHINE AND TOOL CO., INC.—390.
Three filing and sawing machines for die making and production work.
T. W. Witters, pres. and genl. mgr.; R. N. Brayer, Detroit rep. of Boyer Campbell Co.

LEEDS AND NORTHRUP CO.—161-163-165.
Homo electric furnace; Hump electric furnace; potentiometer pyrometers; indicators and recorders, automatic recording controllers; optical pyrometers.
G. W. Tall, Jr., Henry Brewer, A. E. Tarr, P. H. Taylor, J. W. Harsch; E. B. Estabrook, A. F. Moranty, T. C. Smith, G. P. Docherty, J. Korp, C. O. Anderson, T. C. Bennett, R. E. Hansen, W. D. Trueblood, Jr., J. S. Vecella.

LEITZ, INC.—451-478.
"Metallurscope," a portable micrometallograph of simplified construction; "Micro-Metallograph" of large size; grinding and polishing machine for specimens.
R. Tvestmann, Oscar Soetbeer, A. I. Buehler.

LINDE AIR PRODUCTS CO.—167-169-171.
171.
Products fabricated by the oxy-acetylene welding process, including an all-welded airplane fuselage; the Stel-

liting process; cast iron cutting, bronze welding; steel plate welding, etc.

R. W. Boggs, W. R. Clark, H. H. Dyar, T. C. Fetherston, R. G. Gunther, F. Langstrom, L. M. Strope, A. G. Wikoff, W. Wissler.

LUDLUM STEEL CO.—349 and 368.

Ammonia hardening steel—NITRALLOY, with demonstration of hardening in ammonia gas at low temperatures without deformation: DELHI rustless irons and stainless steels.

H. G. Batcheller, v.-p., sales mgr.; W. H. Vrooman, C. B. Templeton, asst. mgrs.; R. P. DeVries, H. A. DeFries, metallurgists; V. O. Homerberg, consultant; Wm. A. Weaver, New York rep.; R. P. McCarty, Connecticut rep.; E. R. Reeder, Boston dist. mgr.; P. R. Thurston, W. Kinsey, Cleveland dist.; J. E. Polhemus, Detroit dist. mgr.; H. W. Spiegel, H. I. Askew, J. J. Cruice, A. E. Hope of the Detroit dist.; P. E. Floyd, Chicago dist. mgr.; G. L. Hulben, Chicago.

— M —

MACLEOD CO.—241.

Sand blast cabinet; sand blast hose machine; paint sprayer; electric butt welder; electric rivet heater.

James Lauder, Walter MacLeod.

MACKINTOSH-HEMPHILL CO.—453.

Adamite forming dies for the cold working and forming of light steel plate; permanent molds for aluminum castings; tube mill sizing rolls; roll dies; gears; hammer dies; aluminum melting pots.

J. R. Patterson, mgr. of Adamite sales; J. M. Lewis, sales; D. L. Mathias, adv. mgr.

MAHR MANUFACTURING CO.—115.

Oil-fired, steel-cased and insulated heat-treating furnace with temperature automatically controlled by the Mahr-Harris oil-controlled valve and solenoid-operated air valve.

W. G. Barstow, sales mgr.; C. F. Olmstead, asst. sales mgr.; R. M. Hortvet, eng. dept.; A. E. Stenzel, sales rep., Detroit; Benjamin G. Harmon, dist. mgr., Chicago; C. W. Rudolph, sales rep., Chicago; Ray C. White, dist. mgr., New York City.

McCROSKY TOOL CORPORATION.—234.

Adjustable reamers, hand machine and shell types; WIZARD quick-change chucks and collets.

F. P. Miller, pres.; C. M. Sutton, Detroit mgr.; R. W. Thomas, genl. mgr.; Frank Walster, shop supt.; S. P. Miller, treas.; Lewis Skeel, eng.; Fred Fisher, W. J. Greenleaf, K. B. Spaulding, T. J. Fraser, I. F. Belknap, sales.

McGILL METAL CO.—413.

Precision ball bearings in radial, angular contact, and thrust types, for machine tool or other applications.

Frank R. Schubert, v.-p.; Walter E. Brownell, treas.; Thomas L. Robinson, chf. engr.

MERIT OIL EQUIPMENT CO.—260.

DEMCO high-speed, ball-bearing, sensitive drilling machines.

METAL AND THERMIT CORPORATION.—147.

Various metals and alloys manufactured; appliances for welding in steel mills.

J. H. Deppeler, chf. engr.; W. R. Hulbert, sales mgr.; C. D. Young, Chicago dist. mgr.; R. L. Browne, New England dist. sales mgr.; A. F. Braid, sales mgr. metals and alloys department.

METALWOOD MANUFACTURING CO.—211A.

Hydraulic broaching press; duplex nut-driving machine.

H. C. Nye, shop supt.; G. N. Door, engr.; Mr. Reynolds, designer.

MICHIGAN TOOL CO. & COLONIAL TOOL CO.—362.

Broaches and spline gages; high-speed steel broaches for use on high-speed hydraulic broaching machines; ground and formed tooth hobs; gear shaper cutters; milling cutters; special form milling cutters; saws for steel, copper and mica; other standard and special metal cutting tools.

E. H. Kurtz, T. A. Oleck, James McKay, Carl Halborg.

MIDVALE CO.—363.

Heavy finish machined forgings; high-speed steel; hardened and ground forged-steel rolls and stainless steel.

Dr. H. L. Frevert, v.-p.; Stuart Hazlewood, v.-p.; Fred Sager, dist. mgr. of sales, Chicago; W. B. Smyth, dist. mgr. of sales, Cleveland Harvey Ganett, dist. mgr. of sales, Pittsburgh; W. A. Miller, dist. mgr. of sales, New York; Henry Ziesing, H. E. Rowe.

MILBURN CO.—122B.

Combination cutting and welding torch; regulators, generators, accessories and supplies; paint and lacquer spray equipment.

C. R. Pollard, sales mgr.

MILWAUKEE DIE CASTING CO.—395A.

Bronze-back, babbitt-lined bearings.

Charles Grebe, supt.; C. H. Frantz, sales engr.; C. H. Reynolds, Michigan rep.

MOLYBDENUM CORPORATION OF AMERICA.—322.

Tungsten and molybdenum ores; ferro-tungsten and ferro-molybdenum; other molybdenum products.

Clifton Taylor, sales mgr.; G. M. Eaton; W. H. Phillips; E. A. Lucas, wks. mgr.

MORSE TWIST DRILL AND MACHINE CO.—319.

Twist drills, reamers, milling cutters, taps, dies and special tools of both high-speed and carbon steel.

W. T. Read, v.-p. and treas.; F. O. Lincoln, v.-p.; W. F. Congdon, Detroit; R. W. Mein.

MOTCH AND MERRYWEATHER MACHINERY CO.—259, 261 and 263.

Products of Keller Mechanical Engineering Corporation, Cincinnati Planer Co., V and O Press Co.

Representatives as given under listing of three companies.

MUELLER BRASS CO.—423.

Forgings in brass, bronze, copper and special alloys, seamless brass and copper tubing, and brass and bronze rods.

R. P. Winberg, asst. sales mgr.; F. L. Riggin, secy. and sales mgr.; B. F. Mueller, asst. treas.; R. C. Hunter, H. V. Wilkie, H. A. Kliemann, Detroit reps.; A. Duce, Chicago rep.; L. A. Mitchell, Detroit rep.

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NATIONAL ELECTRIC LIGHT ASSOCIATION.—434.

Continuous motion picture of applications of electric heat to heat treating.

NATIONAL MACHINERY CO.—254.

Working models of forging equipment; sample forgings.

O. C. Mahon, G. R. Murray, Racine Ripley, D. M. McDowel, E. B. Huber, E. R. Frost, J. H. Friedman, D. J. Crowley, K. L. Ernst, C. D. Harmon, Clyde Bordner.

NATIONAL TWIST DRILL AND TOOL CO.—223, 225, 246 and 248.

Parabolic plain milling cutters mounted on a high-power milling machine; high-speed steel cutting tools including twist drills, reamers, milling cutter, hobs and special tools.

H. L. McGregor, pres. and genl. mgr.; C. E. Smith, v.-p. and mgr. of sales; E. J. Chamberlain, mgr. Chicago branch. Sales dept.; J. L. Cook, M. R. Jeffery, J. S. Fogarty, J. W. Davidson, Paul Jerome, C. C. Cornwall, George Ringstad, adv. mgr. F. G. Wright, George Webster, service dept. W. G. Base, plant mgr.; C. J. Oxford, chf. eng. and plant supt.; D. J. Sullivan, eng. dept.

NORTHWESTERN MANUFACTURING CO.—149A.

Complete portable welding set consisting of a 300-amp. Hansen arc-welding generator, direct connected to a 20-hp. self-starting squirrel-cage motor, with automatic starter for the motor, and instrument panel for the welding generator.

K. L. Hansen, eng.; A. W. Vinson, sales mgr.

NORTON CO.—425 and 427.

Segmental wheels, special chuck for Blanchard machine, special wheels for cutting off wheels and a machine designed especially for high-speed work; Norton refractory ware, consisting of heat-treating furnace tile and hearths, baffle bricks and supports, and other shapes.

H. W. Dunbar, asst, genl. sales mgr.; Herbert Duckworth, sales mgr. wheel division; Harry B. Lindsay, sales mgr. refractories division; W. R. Moore, asst. sales mgr. wheel division; C. W. Jinnette, dist. mgr. wheel division; A. G. Green, sales engr. Salesmen: W. T. Cushing, D. L. Price, P. B. Brown, H. A. Blackburn, K. H. Bird. H. R. Sandberg, publicity dept.

NUTTAL CO., R. D.—483.

Reduction gear units and speed reducers, with single helical gears, Timken roller bearings, a rigid, ribbed, three-section case, and a positive splash lubrication system; flexible couplings, heat-treated and hardened gears.

Milton Pupert, v.-p.; R. F. Fiske, sales mgr.; J. E. Mullen, asst.; C. H. Parker, sales engr.; J. T. Howat, metallurgist; Allan H. Cass, adv. dept.

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OHIO STEEL FOUNDRY CO.—357.

Fahrite heat-resisting alloy castings, including carbonizing boxes, retorts, disks for continuous annealing furnaces, pans and trays for mechanically operated heat treating furnaces.

J. E. Galvin, pres.; C. E. Malley, mgr. alloy div.; W. J. Hayes, sales mrg.; Everett C. White, Detroit rep.; W. J. Gilmore, genl. wks. mgr.

O. K. TOOL CO., INC.—238.

Standard tools for lathe, planer, shaper, boring mill and special purpose machines, also the inserted tooth milling cutter for all purposes.

R. R. Weddell, engr.; Frederick Schroeder, Edward E. Fiege, John W. Costello, sales.

OLSEN TESTING MACHINE CO., TINIUS.—379-398.
Testing machines, including 50,000-lb. capacity automatic and autographic universal testing machine; universal efficiency testing machine for determining cutting properties of various forms of tools; and several others.
Thorsten Y. Olsen, v.-p. and treas.; Jacob Lundgren, chf. engr.; K. B. Lewis, engr.

— P —

PAGE STEEL AND WIRE CO.—149.
Armco gas-welding wire; Armco electrodes; steel gas-welding wire; steel electrodes; welded specimens.
W. T. Kyle, sales mgr.; C. A. McCune, director of research; J. J. Flaherty, S. B. Cairns, L. S. Lankton.

PARK CHEMICAL CO.—309A.
Case hardening compounds; cyanide mixtures; reheating salts; drawing salts; lacquer rubbing compounds.
F. W. Faery, J. C. Thompson, J. N. Bourg.

PARKER-KALON CORPORATION.—328A.
Hardened metallic drive screws; hardened self-tapping sheet metal screws.
Robert Mitchell, Detroit sales mgr.; N. Nettleton, Detroit rep.; H. Goldburg, New York rep.

PARKER RUST PROOF CO.—160.
Rust-proofing powdered chemicals; samples of iron and steel articles which have been Parkerized.
R. C. Bristol, pres.; C. H. Awkerman, v.-p.; G. E. Luke, sales mgr.; J. W. Sweet, adv. mgr.; M. Green, chemist; D. J. Neville, service mgr.; D. W. Crabbs, foreign mgr.

PELS & CO., INC., HENRY.—233.
Guillotine bar and billet shear; portable open throat bar shear; triple combined punch, splitting shear, bar angle and tee cutter, and others.
Ingo Maddaus, pres.; E. E. Tailfer.

PENINSULAR STEEL CO—481.

PENTON PUBLISHING CO.—343.
Technical and commercial periodicals and books dealing with forging, heat-treating, and other branches of iron and steel working.
J. D. Pease, v.-p.; F. V. Cole, sec'y.; V. I. Dolan; L. C. Pelott, western mgr.; John Henry, sales promotion mgr.; A. L. Klingeman, Ohio mgr.; W. J. Chapman; W. H. Blair; E. L. Shaner, man. ed.; E. F. Ross, assoc. ed.

PITTSBURG CRUCIBLE STEEL CO.—418A.
K. E. Porter.

PITTSBURGH INSTRUMENT AND MACHINE CO.—446A.
Brinell hardness-testing machines for hand and motor power; microscope, for hand and motor power, with illuminator; depth gage; impact-testing machine; metallographic grinder.
Charles Trueg, partner.

PLIBRICO JOINTLESS FIREBRICK CO.—442.
Jointless Plibrico furnace lining.

POTTER AND JOHNSTON MACHINE CO.—222.
Automatic chucking and turning machines.
Norman R. Earle, mgr. of sales; G. Tell DuBois, mgr. Detroit sales office.

PRATT AND WHITNEY CO.—393-393A.
Taps, dies, reamers, cutters, hobs, etc.; precision gages; supermicrometer; method used for inspecting precision gage blocks for flatness.
Clayton R. Burt, v.-p. and gen. mgr.; Charles M. Pond, mgr. small tool and gage divisions; A. H. d'Arcambal, sales mgr. and consult. metallurgist; H. W. Kopf, sales mgr., Detroit dist.; H. H. Wilbraham, small tool and gage sales mgr., Detroit dist.; E. C. Godfrey, sales rep. Detroit dist.; W. H. Gourlie, special gage rep.

PROCUNIER, W. L.—388.
Tapping attachments; safety tapping chucks; tap holders; bench tapping machines; quick-change chucks and collets; stud setting devices.
H. G. Procunier, genl. mgr.

PRODUCTION MACHINE CO.—263A.
Polishing and finishing machines; surfacer, screw plates; taps; dies.
William S. Howe, pres.; Arthur H. Behnke, v.-p. and sales mgr.; Leon Kinsman, service engr.

PYROMETER INSTRUMENT CO.—347.
Radiation pyrometers; insertion pyrometers; optical pyrometers.
E. R. Wilner, pres.; F. Heidorn, sales mgr.

— R —

RAIL JOINT CO.—122E.
Rail joints, including continuous joints and special plates for welding.
Victor C. Armstrong, pres.; Edward A. Condit, Jr., v.-p.; Clarkson A. Disbrow, rep.

REEVES PULLEY CO.—361.
Variable-speed transmission.
C. M. Reeves, v.-p.; C. B. Mott, mgr. Detroit branch; R. H. McLean, R. E. Hill.

ROCKWELL CO., STANLEY P.—317.
A laboratory model, for the determination of critical points in steel or for measurement of thermal expansion; standard production-type electric furnace 10-in. diameter by 16 in. deep, equipped with the Rockwell Dilatometer for heat-treatment of tools, dies, gears, etc., by the Volcrit method.
Stanley P. Rockwell, Warren D. Fuller, Raymond W. Woodward, Kenneth Stumpf.

ROCKWELL CO., W. S.—157.
Photographs and catalogs of furnaces.
R. M. Atwater, H. N. Voltmann, C. P. Cogswell.

ROEBLING'S SONS CO., JOHN A.—173-175.
Gas and electric welding wire; two miniature railroad shops in operation.
R. R. Newell, sales mgr., Cleveland dist.; G. W. Swan, sales rep., Buffalo; E. M. Dixon, Detroit; E. King, Detroit; A. E. Gaynor, New York; E. T. Wert, Chicago; F. J. Maple, adv. mgr., Trenton.

ROESSLER AND HASSLACHER CHEMICAL CO.—485.
Cyanide mixtures; cyanides; chemicals for heat-treating and electroplating; samples of case- hardened and localized copper plated steel parts; electroplating with copper, zinc, and Cad-A-Loy.
W. M. Gager, heat-treating expert; C. H. Proctor, electroplating expert.

ROLLWAY BEARINGS CO., INC.—272.
C. A. Call.

ROTOR AIR TOOL CO.—140.
Portable pneumatic grinders, including right-angled machines, extension grinders, and rotor sander.
H. P. Bailey, pres.; K. L. Pohlman, v.-p.; C. S. Stilwell, Detroit dist. mgr.; C. B. Hunt, sales engr.; C. W. Campbell, E. C. Wilson, J. F. Slavik, M. B. Johnson, Detroit reps.

RUMMINS AND MURRAY, INC.—338A.
Machine tools, gages and appliances made by Standard Gage Co., Wetmore Reamer Co., West and Dodge Thread Gage Co., Charles L. Jarvis Co.
E. D. Rummins, J. K. Murray, Erik Aldeborgh, W. E. Richie, M. N. Jarvis, R. G. Low, Ed. Johnson

— S —

SENECA FALLS MACHINE CO.—232.
Automatic and Semi-automatic LO-SWING lathes; SHORT CUT production lathes; STAR screw-cutting engine lathes.
E. R. Smith, v.-p. and genl. mgr.; J. A. Fyfe, sec.; W. H. Nettle, Detroit dist. rep.; John A. Camm, Milwaukee-Chicago dist. rep.; F. B. Webb, M. C. Day, sales engrs.

SENTRY CO.—135.
High-speed steel hardening furnace for temperatures up to 2400 deg. F. and a smaller furnace for 1600 deg. F.
Edwin I. Hope, sec. and sales mgr.; P. B. Crocker, treas. asst. mgr.

SHAWINIGAN PRODUCTS CORPORATION.—124B.
Calcium carbide in various commercial sizes.
Henry Booth, sales mgr.; A. F. Wall, Detroit dist. mgr.; W. P. Chur, Pittsburgh dist. mgr.

SHENANGO PENN MOLD CO.—391-A.

SHORE INSTRUMENT AND MANUFACTURING CO.—447.
Scleroscope, recording and bulb types with all improvements; Pyroscope; Durometer; Elastometer; Localcase; Localhard.
F. G. Kendall, sales mgr.

SIMONDS SAW AND STEEL CO.—373.
Metal cutting saws, circular and band; files; hack saw blades; machine knives; tool steel; magnet steel; special analysis steel.
H. B. McDonald, metal saw engr.; George R. Bird, Detroit sales mgr.; C. R. Pafenbach, steel sales mgr.

SKINNER CHUCK CO.—386.
Two- and three-jaw air-operated chucks of the adjustable and non-adjustable types, also hand-operated chucks.
K. H. Walther, engr.

SLEEPER AND HARTLEY, INC.—243.
Standard universal coilers, as used by spring makers.
P. E. Mignacca.

SOUTHERN MANGANESE STEEL CO.—460.
Castings of Fahralloy; non-cooled shaft for use in continuous annealing and normalizing furnaces; Fahralloy chain; carburizing boxes.
E. F. Mitchell, sales mgr.; D. M. Powers, Cleveland agt.; E. M. Porter, Detroit agt.; Dr. F. A. Fahrenwald, consulting metallurgist.

SPENCER TURBINE CO.—112.
Turbo-compressor for supplying air for oil-and gas-burning industrial furnaces.

S. E. Phillips, sec'y.; H. M. Grossman, sales engr.; R. B. Richardson, Detroit mgr.

SQUARE D Co.—345A.
Magnetic switch with push button control convertible power panel; industrial safety switches; tester which indicates voltage, whether current is a.c. or d.c., locates open circuits, blown fuses and motors running single-phase.
A. A. Schueler, sales mgr.; C. E. Cook, Detroit sales mgr.; C. L. Hull, asst. sales mgr.; K. H. Bronson, adv. mgr.

STANDARD ELECTRICAL TOOL Co.—215.
Electric drills; electric driven grinders; buffing and polishing machines.
G. H. Feltes, pres. and treas.; C. C. McGill, dist. mgr., Detroit; R. C. Feltes, dist. mgr., Chicago.

STANDARD FUEL ENGINEERING Co.—118.
Oil-tempering furnace with atmospheric burner and thermostatic temperature control; lead and cyanide furnace.
George H. Willett, pres.; John A. Willett, v.-p.; Hosmer M. Lathrop, sales dept.; E. P. Beeman.

STANDARD GAGE Co., INC.—238-A.
Johansson gage blocks made by Ford Motor Co., and precision gages.
Erik Aldeborgh, pres.; W. E. Ritchie, supt.

STANDARD OIL Co., (Indiana).—242.
N. H. Reed.

STANDARD STEEL AND BEARINGS, INC.—387.
Aircraft engines in which S.S.B. bearings are used; ball bearings in various stages of manufacture.
W. H. Hill, sales mgr.; L. A. Cummings, chf. engr.; A. E. Fawley, engr.; G. C. Warner, sales; B. J. Shallow, asst. sales mgr.; E. J. McAvay, service engr.

STANDARD TOOL Co.—484.
Twist drills; reamers; milling cutters; taps.
M. A. Jackson; J. G. Green.

L. S. STARRETT Co.—249A.
Mechanical tools; hacksaw blades; steel tapes, etc.
O. H. Leidy, Detroit rep.; B. L. Webb, Michigan rep.; F. A. Ball, pres.; D. Findlay, sales mgr.; A. H. Starrett, master mechanic.

STEEL CITY TESTING LABORATORY.—344.
Power and hand-operated Brinell machines; portable hardness testing hammer; SKW adapter for scleroscope; dead-weight testing machine; etc.
H. A. Weaver, genl. mgr.; Messrs. Nass and French, assts.

STEEL PUBLICATIONS, INC.—433.
Forging-Stamping-Heat-Treating; Blast Furnace and Steel Plant; Iron and Steel Directory.
D. N. Watkins, pres.; M. M. Zeder, sec.; Charles J. Jacob, prod. mgr.; Charles Langenecker, ed.; Robert E. Powell; H. Milton Reich.

STRAND Co.—386.
Flexible shaft grinding and polishing machines; rotary filing machine.
Clyde W. Blakeslee, sales mgr.; N. A. Strand, pres.

STRONG, CARLISLE AND HAMMOND Co.—155.
High-speed furnace; electric babbitt melting furnace; electric lead hardening furnace; continuous annealing furnace.
J. Weintz; G. S. Peterson; A. B. Lindsay.

STUART AND Co., D. A.—342.
Parts treated with Super-kool base oil; Thred-kut bolt-threading oil; thred-kut broaching oil; Kleen-kut soluble oil; Dasco tempering oil; Dasco quenching oil; Codol liquid grinding compound.
Charles A. Day, pres.; Tracy B. Langdon, sales mgr.; William H. Oldacre, factory mgr.; W. F. Farlowe, Detroit; C. H. Baker, Ohio.

SULLIVAN MACHINERY Co.—North Woodward Annex.
Exhibiting with American Gas Association.

SURFACE COMBUSTION Co.—North Woodward Annex.
Roller-hearth type, gas-fired, automatic-temperature, automatic-combustion-controlled furnace for reheating or heat-treating operations.
H. M. Heyn, mgr. Detroit dist. office; A. L. Hollinger, mgr. Pittsburgh dist. office; C. B. Phillips, mgr. standard equipment sales; F. W. Manker v.-p. and genl. sales mgr.

SWEDISH CHARCOAL STEELS, INC.—381 and 81A.
Samples of tool steels showing fracture; Swedish ores; Swedish charcoals; pig iron; slag, etc.
S. F. Wollman, v.-p.; H. C. Moore, dist. rep.

SWEDISH CRUCIBLE STEEL Co.—364.
Nickel-chromium alloy carbonizing boxes and covers; nickel chromium alloy rails; furnace parts; retorts, etc.; crucible-steel cyanide and lead pots; steel carbonizing boxes and covers.
H. K. Nixon, metallurgist; L. W. Hottel; S. R. Allen, sales mgr.; J. Kauffman.

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TATE-JONES AND Co., INC.—119.
Gas, oil, and combination gas and oil burners; small general hardening furnace; blast gates; duplex oil strainers.
E. O. Mueller, Cleveland rep.; P. J. Myall, Chicago rep.; W. H. Scheib, Pittsburgh rep.

TAYLOR INSTRUMENT COMPANIES.—326A.
Temperature instruments, including electrical pyrometer equipment; and accessories; thermometers; high and low temperature automatic oven and furnace controllers; recording thermometers and pyrometers; thermopyres; thermocouples; etc.
G. A. Howell, sales dept.; H. A. Irving, sales engr.; H. A. Hohes, Detroit sales rep.

TAYLOR WINFIELD CORPORATION.—170.
Electric welding machines.
A. C. Taylor, pres.; W. A. Jones, sales engr.; The Denton and Anderson Co. reps.

THOMSON ELECTRIC WELDING Co.—125.
Double roller seam welder that does not require air pressure for securing enough squeeze to seam weld two pieces of ¼-in. material; butt welder; spot welders.
H. B. Warren, sales mgr.; W. T. Ober, asst. sales mgr.; James A. Muir, Detroit; C. E. Seifert, Cincinnati; R. B. Strout, Chicago.

THOMPSON AND SON Co., HENRY G.—252.
Spring temper metal cutting band saw for cutting sheet metals; Milford and Mil-flex backsaw blades; flexible back metal cutting band saws; Mi-hy high-speed steel hacksaw blades.
Fellowes Thompson, sales mgr.; Thomas A. Hyde; H. B. Norris.

TIMKEN ROLLER BEARING Co.—420.
Photographs of plant and various operations, with samples of bearings.
M. T. Lothrop, v.-p.; A. J. Sanford, mgr. steel sales; C. A. Swan, asst. mgr. steel sales; Robert Atkinson, Detroit dist. steel sales; S. D. Williams, sales; Thomas W. Hardy, John E. Frick, metallurgists.

TOMKINS JOHNSON Co.—307.
Die-sinking milling cutters; universal work stand; chucks and cylinders.
H. A. Tomkins, pres. and genl. mgr.; G. F. Hopkins, engr.; A. R. Johnson, v.-p. and treas.; R. B. McDonald, A. C. Haberkorn, sales.

TORCHWELD EQUIPMENT Co.—129.
Non-flash gas welding units; hand welding torches; machine welding torches; gas cutting units; hand cutting torches; etc.
W. A. Slack, pres.; Russell Smith, sales mgr.; Harvey G. Larisch, Cleveland; Albert W. Fry, Detroit.

TRANSUE AND WILLIAMS STEEL FORGING Co.—488.
Forgings and stampings, together with special exhibit of grain flows in forgings.
F. W. Trabold, pres. and genl. mgr.; R. C. Yates, sales mgr.; L. D. Keplinger, F. A. Zeller, J. A. Saylor, R. L. Pointer, L. D. Rockwell, W. T. Cullen, sales.

TUFFLEY BURNER CORPORATION.—136A.
Low-pressure burner in operation in a furnace.
G. I. McDermott, pres.; S. M. Michael, sec.-treas.

TUTHILL PUMP Co.—268.
Motor-drive pumps for oil burner service.
H. E. Kempton, wks. mgr.; O. L. Bock, mid-western sales rep.; J. P. Lacey, eastern sales rep.; J. N. Jensen, chf. engr.

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UNA WELDING AND BONDING Co.—126B and 126E.
N. E. Gage.

UNION DRAWN STEEL Co.—452.
Cold-drawn steel in rounds, flats squares, hexagons, special shapes; screw machine products made from cold-drawn steel; cold-drawn elevator guides; and finished crankshafts.
E. S. Hoopes, pres.; George B. Mitchell, v.-p. of sales; L. E. Creighton, v.-p. of operations; C. H. Beegle, asst. sec. Dist. sales mgrs.: B. H. Elliott, L. H. Carlisle, George L. Anderson, F. C. Young, J. D. Armour, chf. met.; E. A. Griffiths, Massillon plant mgr. R. G. Merchant, W. A. Van Wicklen and J. M. Johnston, sales. J. A. Quay, asst. mgr of sales.

UNISHEAR Co., INC.—270.
Complete line of Unishears.
Max Carsen, Chicago, mgr.; Tom H. Collard, Detroit mgr.; H. J. Heller, v.-p.; U. Steindorff, pres.

UNIVERSAL STEEL CO.—385A.
Sheets of carbon and alloy steels; bars of carbon, alloy and high-speed tool steels; heat-resisting and non-corrosive steels and alloys; cold-drawn bars and cold-rolled sheets.
Rep. Universal Steel Co.; J. O. Rinek, asst. genl. mgr.; W. G. Miller, genl. supt.; Frank Garratt, sales metallurgist; Frank Saltsman, sales; H. M. German, metallurgist; H. C. Copp, Jr., met. dept. Rep. Cyclops Steel Co.: Charles Evans, genl. mgr.; Charles Ridgeway, sales. A. F. McFarland, Detroit.

— V —

VANADIUM-ALLOYS STEEL CO.—311-330.
Hot and cold die tools; special tools; samples of cold-drawn steel, and files; high-speed, alloy, and carbon tools.
Roy C. McKenna, pres.; Floyd Rose, v.-p. Rep.: R. R. Artz, W. D. Fisher, T. W. Schein, Detroit; W. R. Mau, Chicago; H. P. Edison, Pittsburgh; M. W. Caruthers, New York.

V & O PRESS CO.—262.
Geared inclinable press equipped with King pressure toggle.
H. U. Herrick, pres. and genl. mgr.; F. A. Beardsley, sales mgr.; H. F. Zorn, supt.

VICTOR-PENINSULAR CO.—380.
Heat-treated, cold headed capscrews and special bolts.
T. S. Higbee, tech. dept.; Harold Stark, chf. met.; Fred Ladd, asst. met.; H. E. Moblo, sales.

VULCAN CRUCIBLE STEEL CO.—387A.
High-speed alloy, and carbon tool steels; special steels.
S. G. Stafford, pres.; R. M. Kelso, A. D. Beeken, Jr., S. A. Stafford, W. H. Norris, L. D. Sullivan, Detroit mgr.; E. H. Lurker, Chicago; A. Hartel, Jr., Boston.

— W —

WALL BROTHERS CO.—124B.

WATERBURY FARREL FOUNDRY AND MACHINE CO.—217-219.
Eyelet machine with tools; upright roll wire drawing machine; solid die double stroke header; bolt trimmer; pointer and threader.
G. R. Lamb, mgr.; W. A. Spear, sales Cleveland; J. M. Schaeffer, F. S. Van Valkenburg and G. W. Jackman, sales engrs.; S. Hallaway, C. Scuillo, operators.

WELDING ENGINEER PUBLISHING CO.—128B.
Magazines, books and booklets pertaining to all classes of welding operations.
Rep. the *Welding Engineer:* T. E. DePew, Eastern mgr.; Leo Ehlbert, Cleveland mgr.; H. S. Card, ed.; H. P. Ritsch, asso. ed., rep. the *Acetylene Journal;* M. S. Hendricks, man. ed.

WELDIT ACETYLENE CO.—151.
Welding torches; cutting torches; oxygen and acetylene regulators; decarbonizing equipment; supplementary parts.
O. S. Smith, pres.; W. E. Massey, v.-p.; J. B. Manor, engr.; J. W. Keyes, J. S. Westbrook, J. McManus, M. Gallo, D. Ditier, D. Haselton.

WEST & DODGE THREAD GAGE CO.—238-A.
Thread and spline gages.
R. G. Low, pres.

WESTINGHOUSE ELECTRIC AND MANUFACTURING CO.—123-144.
Electric furnaces; electric arc welding machines; frequency changers for machine tool operation; small high-frequency drill motors.
W. W. Reddie, motor generator and welding section; F. B. Harvey, motor apparatus sales; A. M. Candy, general engr.; Edwin Fleischmann, industrial heating engr., Chicago; D. H. Byerly, small power motor section, East Springfield; C. L. Wilson, industrial heating engr., Detroit; G. H. Haynes, adv. dept., Mansfield; T. C. Kelley, industrial heating apparatus sales mgr., Mansfield; J. C. Woodson, mgr. industrial heating and engr. dept, Mansfield.

WETMORE REAMER CO.—238A.
Adjustable blade production reamers.
Ed. Johnson, factory mgr.

WHEELOCK, LOVEJOY & CO., INC.—418.
Hy-ten alloy machinery steels; Whelco tool steels in their application to special parts.
A. Oram Fulton, pres.; F. H. Lovejoy, v.-p.; H. M. Foster, New York; E. C. Bartlett, Cleveland; G. A. Baron, M. M. Allison, C. R. Jenks, Cleveland sales; L. P. Needham, Chicago mgr.

WHITMAN-BARNES DETROIT CORPORATION.—325.
Twist drills; reamers; milling cutters; end and hollow mills; counterbores; enter points and holders.
R. Hammersley, wks. mgr.; H. Z. Callender, sales mgr.; A. B. Hall, F. J. Smith, H. J. Lincoln.

WHITNEY MANUFACTURING CO.—486.
Chain drives showing the application to varying degrees of speed of three distinct types of chain for different service.
R. A. Follensby, Detroit mgr.; D. I. Wheeler, sales engr.; H. L. Ames, engr., Detroit; and E. H. Huntington, Chicago mgr.

WHITNEY METAL TOOL CO.—251.
Ball bearing punches; shears; angle iron roll, power driven.
Gus Jensen, sales; John Jensen, sec.

WICKWIRE-SPENCER STEEL CO.—130B.

WILLIAMS & CO., J. H.—366.
Agrippa tool holders; Vulcan clamps, lathe dogs and snap gages; drop forged wrenches made of carbon steel; Superrenches of chrome-molybdenum steel.
J. C. Scanlon, genl. sales mgr. special forgings; A. S. Maxwell, genl. sales mgr. stock products; A. C. Nuth, V. E. Nagle.

WILSON-MAEULEN CO., INC.—479.
Recording pyrometers; indicating pyrometers; automatic temperature controllers; electric resistance bulb thermometers; Rockwell hardness testers.
C. E. Hellenberg, Detroit; M. A. Schreiner, Chicago.

WITHEROW STEEL CORPORATION.—300.
Rolled steel bars of variable section, including street railway tie rods, steering tie rods for automobiles, rear axle shafts, front axles, camshaft blanks and gear shift levers.
W. P. Witherow, pres.; J. S. Langston, genl. sales mgr.; W. C. Emory, sales mgr.; E. H. Vogel, sales engr.

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YOUNG BROTHERS CO.—154A.
Electric laboratory ovens; working models of continuous conveyor ovens.
George A. Young, pres.; R. B. Reed, sales mgr.; C. G. Lisch, asst. sales mgr.; V. A. Fox, chief engr.

— Z —

ZIV STEEL AND WIRE CO.—318-320.
Dies and tools made from the various brands of Ziv's steels; special tools and dies made from Neor and PRK steels.
G. F. Ziv, pres.; A. Ziv, v.-p.; N. J. Hyslip, genl. sales mgr.; A. F. Brunck, sales mgr.; R. J. Foley, sales; H. F. Kluender, mgr., Detroit; H. E. Ziv, asst. mgr., Detroit; V. F. J. Tlach, pres. Darwin & Milner, Inc.

PROGRAMS

Technical Meetings · Plant Visits · Entertainment

[Both Expositions]

THE program of technical papers and plant inspection tours that will be offered in Detroit and Cleveland during the week of Sept. 19 by the four engineering bodies meeting in those cities, is given here. The papers are grouped in one section, the plant inspection tours in another and the entertainment features for each society listed in another.

A. S. S. T. Technical Program

Hotel Statler, Detroit

Monday, A.M.

AIRCRAFT METALLURGY, by H. C. Knerr, Philadelphia.

DEEP ETCH METHOD FOR TESTING STEEL, by H. G. Keshian, Waterbury, Conn.

HARDENING BY RE-HEATING AFTER COLD WORKING, by Marcus A. Grossman and C. C. Snyder, Central Alloy Steel Corporation, Canton, Ohio.

PATENTING OF STEEL, by J. S. G. Primrose, Manchester, England.

FURNACE DEVELOPMENT IN HEAT-TREATMENT AND FORGING, by W. M. Hepburn, Surface Combustion Co., New York.

Monday, P.M.

FATIGUE TESTS OF CARBURIZED STEELS, by N. J. Alleman and H. F. Moore, University of Illinois, Urbana, Ill.

TESTING AUTOMOBILE BODY SHEET STEEL, by George L. Kelley, Edward G. Budd Manufacturing Co., Philadelphia.

CARBURIZING IRON BY MIXTURES OF HYDROGEN AND METHANE, by W. Sykes, General Electric Co., Cleveland.

STUDIES OF NORMAL AND ABNORMAL CARBURIZING STEELS, by O. E. Harder, L. J. Weber and T. E. Jerabek, University of Minnesota, Minneapolis.

GAS CARBURIZING OF STEEL, by R. G. Guthrie and Dr. O. J. Wozasek, Peoples Gas, Light and Coke Co., Chicago.

Tuesday, A.M.

STEEL MELTING PRACTICE FOR LARGE INGOTS, HEAVY AND LIGHT, HIGH-GRADE CASTINGS, by W. H. White, Duquesne Steel Foundry Co., Corapolis, Pa.

THE MELTING OR MOLTEN STATE OF STEEL MANUFACTURE WITH PARTICULAR REFERENCE TO THE DEOXIDIZING, REFINING AND CONTAMINATION PHASES, by George A. Dornin, Gathmann Engineering Co., Baltimore.

ARMCO INGOT IRON, by R. L. Kenyon, American Rolling Mill Co., Middletown, Ohio.

THE MANUFACTURING USES OF WROUGHT IRON IN PRESENT DAY INDUSTRY, by James Aston, Carnegie Institute of Technology, Pittsburgh.

SEGREGATION OF DISSOLVED ELEMENTS AND ITS INFLUENCE UPON CARBON DISTRIBUTION IN STEEL, by E. G. Mahin and H. J. Dillon, Notre Dame, Ind.

Tuesday, P.M.

THE DEVELOPMENT OF HIGH-SPEED STEEL HACKSAW OR CUTTING OFF SAWS, by H. B. Allen, Henry Disston & Sons, Inc., Philadelphia.

A HIGH TEMPERATURE QUENCHING TREATMENT APPLIED TO COLD HEADING DIES OF PLAIN CARBON TOOL STEEL, by F. L. Wright, Atlas Ball Co., Philadelphia.

EVALUATING QUALITY OF HIGH-SPEED STEELS BY MEANS OF THE MILLING CUTTER TEST, by J. B. Mudge and F. E. Cooney, Western Electric Co., Chicago.

ON THE CONSTITUTION AND PROPERTIES OF HARDENED STEELS, by W. P. Sykes and Dr. Zay Jeffries, General Electric Co., Cleveland.

Wednesday, A.M.

Annual meeting of American Society for Steel Treating. CAMPBELL MEMORIAL LECTURE, by Dr. Zay Jeffries.

Wednesday, P.M.

JOINT MEETING with the American Institute of Metals.

Thursday, A.M.

ON THE SIGNIFICANCE OF THE PROPORTIONAL LIMIT OF STEEL AT ELEVATED TEMPERATURES, by F. B. Foley, the Midvale Co., Philadelphia.

RECENT EXPERIMENTS RELATING TO THE WEAR OF PLUG GAGES, by H. J. French and H. K. Herschman, Bureau of Standards, Washington, D. C.

WHAT HAPPENS WHEN HIGH-SPEED STEEL IS QUENCHED, by B. H. DeLong and F. R. Palmer, Carpenter Steel Co., Reading, Pa.

ON THE DOUBLE CARBIDE OF HIGH-SPEED STEEL, by Dr. Arne Westgren and Gosta Phragmen, Drottninggatan 95 B, Stockholm, Sweden.

EXPANSION PROPERTIES OF HIGH NICKEL STEELS, by Howard Scott, Westinghouse Electric and Manufacturing Co., East Pittsburgh.

Thursday, P.M.

ON THE DETERMINATION OF THE HETERGENEOUS FIELD IN THE IRON-NICKEL SYSTEM, by Dr. Kotaro Honda and Sansaku Muira, Tohoku Imperial University, Sendai, Japan.

HEAT-TREATMENT OF TWO BALL BEARING STEELS, by Bengt Kjerrman, S. K. F., Gothenburg, Sweden.

DILATOMETRIC ANALYSIS OF STEEL AND SOME RESULTS OF DILATOMETRIC HEAT-TREATMENT, by R. W. Woodward and Stanley P. Rockwell, the Stanley P. Rockwell Co., Hartford, Conn.

THE PHYSICAL PROPERTIES OF SEVERAL CHROMIUM-ALUMINUM AND CHROMIUM-NICKEL-ALUMINUM STEELS, by V. O. Homerberg and I. N. Zavarine, Cambridge, Mass.

THE ECONOMIC VALUE OF NICKEL AND CHROMIUM IN GRAY IRON CASTINGS, by D. M. Houston, International Nickel Co., New York.

Friday, A.M.

DESIGN FROM THE HEAT-TREATING STANDPOINT, by G. M. Eaton, Molybdenum Corporation, Pittsburgh.

FORGING MACHINE DIE DESIGN FOR DEEP PIERCING, by E. R. Frost, National Machinery Co., Tiffin, Ohio.

HIGH TEMPERATURE TREATMENT OF CASTINGS AND FORGINGS AS EVIDENCED BY CORE DRILL TESTS FROM HEAVY

Sections, by W. J. Merten, Westinghouse Electric and Manufacturing Co., East Pittsburgh.

Locomotive Forging Steels, by O. V. Greene, Reading R.R., Reading, Pa.

On a New Method of Quenching Steel in a High-Temperature Bath, by Dr. Kotaro Honda and Kanzi Tamuru, Sendai, Japan.

Friday, P.M.

Relationship Between Rockwell, Brinell and Sclerscope Numbers, by R. R. Moore, Wright Field, Dayton, Ohio.

A Presentation of the Important Properties and Requirements of Some Special Refractories, by H. F. Beecher, Norton Co., Worcester, Mass.

Machinability of Metals, by Orlan W. Boston, University of Michigan, Ann Arbor, Mich.

A Critical Study of the Bend Test as Applied to Iron and Steel, by A. B. Kinzel, Union Carbide and Carbon Research Laboratories, Long Island City, N. Y.

S.A.E. Technical Program

Hotel Statler, Detroit

Wednesday Afternoon

Relation of Metallurgy to Production, by J. M. Watson.

Frequency Curves as a New Basis for S.A.E. Physical Property Charts, by E. J. Janitzky.

Wednesday Evening

Production Engineering, by A. R. Glancy.

Fire Hazards Incidental to the Spraying of Inflammable Finishes, by H. E. Miner.

Thursday Evening

Relation of Time Study to Management, by J. C. Mottashed.

Relation of Time Study to Labor Budgets, by E. J. Frounfelker.

American Welding Society Technical Program

Book-Cadillac Hotel, Detroit

Tuesday, A.M.

Airplane Welding, by J. B. Johnson, Air Corps, McCook Field.

Welding on Long Distance Aircraft, by Curtis Aeroplane Corporation.

Tuesday, P.M.

Study of Welds Subjected to High Temperatures, from the report of investigations made by the San Francisco Section.

Heat-Treatment by the Oxy-Acetylene Flame, by E. E. Thum, associate editor, *Iron Age*.

Metallurgical Study of Welds, by G. R. Brophy, General Electric Co.

Wednesday, A.M.

Car Welding, by Victor Willoughby, American Car and Foundry Co.

Automobile Welding, by W. C. Happ, Studebaker Corporation of America.

Thursday, A.M.

Production Welding of Water Heater, by H. J. Grow, Air Reduction Sales Co.

Welding in the Plant of the Combustion Engineering Co., by C. S. Reed, vice-president and general manager.

Thursday, P.M.

Welding of Structural Steel, by Joseph Matte, Jr., Albert Kahn, Inc.

Welding in the Design of Steel Plate Work, by L. J. Sforzini, Eastman Kodak Co.

Welding and Cutting Exposition

The Welding and Cutting Exposition under the auspices of the American Welding Society, in co-operation with the National Steel and Machine Tool Exposition, will be located in a special section of Convention Hall, occupying about 10,000 sq.ft. of floor space.

A.I.M. Technical Program

Book-Cadillac Hotel, Detroit

Tuesday and Thursday Mornings

Commercial Forms and Applications of Aluminum and Aluminum Alloys, by P. V. Faragher.

Principles Covering the Heat-Treatment of Aluminum, by H. H. Richardson.

Machining Aluminum, by R. L. Templin.

Some Aspects of the Commercial Manipulation of Aluminum, by C. F. Nagel, Jr.

Physical Characteristics of Commercial Copper-Zinc Alloys, by W. H. Bassett and C. H. Davis.

Nickel and Monel Metal, by C. A. Crawford.

Wrought Zinc, by C. S. Trewin.

Equilibrium Relations in Aluminum-Silicon and Aluminum Iron-Silicon Alloys of High Purity, by E. H. Dix, Jr. and A. C. Heath.

Heat-Treatment of Aluminum-Silicon Alloys, by R. S. Archer, L. W. Kempf and D. B. Hobbs.

The Condition of the Thorium Content of Thoriated Tungsten Filaments, by Ancel St. John.

X-Ray Analysis of the Plastic Deformation of Zinc, by T. A. Wilson and Samuel L. Hoyt.

Quantitative Spectrum Analysis, by F. Twyman and D. M. Smith.

Production of Metallic Single Crystals, by J. A. M. Van Liempt.

Twinning in Ferrite, by L. W. McKeehan.

Plant Inspection

A.S.S.T.

Plant inspection for members of the American Society for Steel Treating has been arranged for Tuesday, Wednesday, Thursday and Friday afternoons. All inspection trips will start from the Bagley Ave. entrance of the Hotel Statler.

The inspection trips, as listed below, are open to all members and guests and all members and guests of the other convening societies are privileged to participate in these inspections in case they so desire.

Tuesday, P.M.

Cadillac Motor Car Co.

Dodge Brothers, Inc.

Detroit Steel Products Co.

Ford Motor Co.—Dearborn—Engineering Laboratories and Stout Air Plane Corporation.

Wednesday, P.M.

Lincoln Motor Co.

Hudson Motor Car Co.

General Motors Research Laboratories.
Detroit Seamless Steel Tubes Co.
Victor-Peninsular Co.

Thursday, P.M.

Chevrolet Forge and Axle Plant.
Barnes-Gibson-Raymond, Inc.
Fisher Body Corporation.
Ford Motor Co.—Fordson, formerly the River Rouge Plant.
Detroit Copper and Brass Rolling Mills.
General Motors Proving Grounds (all day trip starts 9:30).

Friday, P.M.

Packard Motor Car Co.
Park-Davis & Co.
Michigan Malleable Iron Co.
Studebaker Motor Car Co.
Detroit-Edison Co.'s Trenton Channel Plant (trip starts at noon).

American Welding Society

Arrangements have been made for inspection tours to the River Rouge Plant of the Ford Motor Co. and to the Ford Airport.

Institute of Metals

Thursday afternoon has been set aside for plant inspection tours by members of this association. On other days members may avail themselves of the trips arranged by the A.S.S.T.

Entertainment

for the A.S.S.T.

Theater Party

The theater party this year will be held on Tuesday evening. Admission by ticket only, secured when registering.

Grand Arabian Ball

One of the high lights of the convention will be the Grand Arabian Ball in the Ballroom of the Statler on Wednesday evening. The room will be transformed into a beautiful Arabian scene. Jean Goldkette's Kentucky Colonels will provide the music. Admission by ticket only, secured when registering.

Golf Tournament

A committee, composed of J. M. Watson, Detroit, chairman; A. O. Fulton, Boston, and W. C. Bell, Cleveland, as members, is in charge of the Golf Tournament, which will be held on one of Detroit's golf courses. The Firth Sterling Steel Co., International Nickel Co., McGill Metal Co., and General Alloys Co. have all donated for prizes a set of stainless clubs, consisting of midiron, mashie, niblick and putter. In addition to the club sets, numerous other prizes will be awarded.

Annual Banquet

The annual banquet of the A.S.S.T. will be held at the Statler, Thursday evening. Two honorary memberships will be conferred and two worth-while speakers will be present. All seats are reserved. Tables seat ten. Dress, formal.

American Welding Society

The annual fall dinner dance of the American Welding Society will be held on Thursday evening in the Book-Cadillac Hotel.

Institute of Metals

The annual dinner of the Institute of Metals will be held on Wednesday evening in the Book-Cadillac Hotel.

Ladies' Entertainment

All ladies attending the convention and exposition will have their entertainment as a single group. This includes the ladies from the four national societies meeting during the week. The registration for ladies of the A.S.S.T. and S.A.E. will be at Hotel Statler. Registration for ladies of the A.W.S. and I. of M. will be at Book-Cadillac.

The program is as follows:

Monday

Luncheon at Statler.
Auto ride about Detroit.
Visit to Exposition.

Tuesday

Shopping tour or bridge party.
Theater party.

Wednesday

Brief auto ride with luncheon at Detroit Yacht Club.
Musicale at the Detroit Yacht Club.
Grand Arabian Ball, Hotel Statler.

Thursday

Theater party at Bonstelle Theater.
Annual Banquet.

Dinner for Drop Forgers

The Drop Forgers' Supply Association is making arrangements to entertain at dinner on Wednesday evening all of the visiting drop forgers in attendance at the exhibit and meetings of the various technical societies. Complete information relative to this dinner may be obtained from Charles Harmon, at the booth of the National Chambersburg Co., space No. 231; or from Mr. Dierckx, at the booth of the Keller Mechanical Engineering Co., space No. 259.

Technical Program

of S.A.E. at Cleveland

Monday, A.M.

NET PROFIT FROM MODERN MACHINE TOOLS, by George T. Trundle, Jr.

MANUFACTURING METHODS USED IN BUILDING THE WRIGHT WHIRLWIND ENGINE, by Lee M. Beatty.

Monday Evening

NON-PRODUCTIVE MATERIALS, by D. W. Oviatt.

INTEGRATED PRODUCTION, by E. P. Blanchard.

Tuesday, A.M.

THE APPLICATION OF ELECTRIC MOTORS TO MACHINE TOOLS, by R. C. Deale.

DEVELOPMENTS IN CYLINDER GRINDING, by M. C. Hutto. (A demonstration of a tamping machine for obtaining uniform hardness of stones will follow this paper.)

EXTERNAL GRINDING, by L. A. Becker.

Entertainment

The annual Stag Carnival will be held in the Rainbow Room of the Hotel Winton on Tuesday evening, beginning at 6:30 and continuing until time to leave for the boat for Detroit.

Machine Tool Congress Technical Program

Hotel Winton, Cleveland

Monday and Tuesday

Deliberative meeting of those wishing to become members of the Congress. Discussions of organization and plans.

Hotel Cleveland, Cleveland

Wednesday and Thursday evenings

VARIOUS PHASES OF STANDARDIZATION OF MACHINE TOOLS, by Dr. P. G. Agnew, secretary, the American Engineering Standards Committee.

ADVANTAGES OF STANDARDIZATION FROM MACHINE TOOL BUILDERS' POINT OF VIEW, by James E. Gleason, president, the National Machine Tool Builders' Association.

STANDARDIZATION FROM THE ENGINEERING POINT OF VIEW, by Sol. A. Einstein, chief engineer, the Cincinnati Milling Machine Co.

Round Table Discussion Topics

(1) The standardization of initial speeds of machine tools.
(2) The standardization of spindle ends of engine lathes, screw machines and grinding machines. (This to include faceplates and chucks.)
(3) The standardization of belt pull.
(4) The standardization of spline shafts.
(5) Standardization of paint colors and materials for finishing.
(6) The urging of standardization of certain fundamental dimensions of motors, pumps and other purchased units for machine tools.
(7) The discussion of the use of flange motors as compared with the usual motor with feet.
(8) Standardization of handwheels, pulleys, bushings, etc., and in general the question of standardizing of parts as compared with practices.
(9) Discussion of the standardization of working ranges, nomenclature, etc.

The Master Tools of Industry

By Loring Roper

Gathered together in Cleveland,
From cities down east and out west,
Shown for the first time together—
Machine Tools—and only the best.

Grinders and shapers and planers,
Gear cutters, broaches and drills,
Slotters and lathes, likewise turrets,
Together with all kinds of mills.

And there's one thing we all should remember,
For it's true and it's free from all jest
That these machines, and no others,
Make possible all of the rest.

Without them, we'd still be in darkness,
No dynamos, motors or looms,
No autos, or e'en locomotives,
No airplane that volplanes and zooms.

For none of our modern equipment,
That both time and labor can save,
Could be made without tools we are showing—
We'd still all be back in the cave.